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FOR THE

PROMOTION OF THE MECHANIC ARTS.

DEVOTED TO

MECHANICAL AND PHYSICAL SCIENCE, CIVIL ENGINEERING, THE ARTS
AND MANUFACTURES, AND THE RECORDING OF AMERICAN
AND OTHER PATENTED INVENTIONS.

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JOURNAL

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THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

JULY, 1850.

CIVIL ENGINEERING.

On the Motion of Water in Conduit Pipes; on Friction and Pressure in Pipes; and on Jets d'Eau. By M. D'AUBUISSON DE VOISINS, *Ingénieur en chef Directeur au Corps Royal des Mines, &c., &c. Translated by* T. HOWARD, *for the Civil Engineer and Architect's Journal.**

[The Work, of which the present translation forms a part, must be considered as the most important and complete modern treatise on Hydraulic Engineering. In it the author has, with admirable clearness and precision, treated the entire question of the Motion of Fluids; and this in such a way as to render it equally inviting to the practical and the scientific man. The object of the translator is to supply a want which English engineers must long have felt—that of an intelligible explanation of the *Motion of Water in Pipes;* and in carrying out this object, he has considered it due to M. d'Aubuisson and the public to give the exact meaning of the author as literally as possible. On the same principle the original equations are given, as well as the same reduced for English feet; for though these reductions have been carefully made, more confidence will be felt in important calculations where both can be referred to. Unless otherwise expressed, the whole of the dimensions in the examples are understood to be in English feet, and the time in seconds.]

Similarity of the Motion in Pipes and in Canals.

1. In a long inclined pipe, as in a canal, water moves by virtue of its gravity or weight, or rather that part of its weight called into action by the

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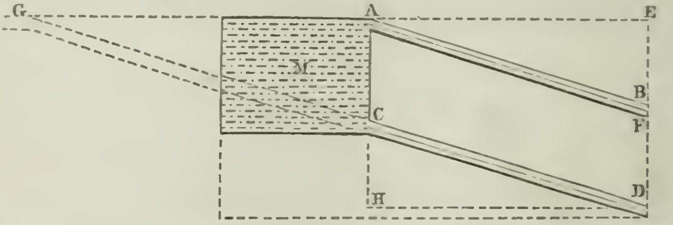
* From the London Civil Engineer and Architect's Journal, for April, 1850.

slope of the pipe;—the accelerating force in both cases is $g\,p$.* So that, if to the upper part of a reservoir M we adapt at AB either a canal or a long pipe,—granting that no obstacle is opposed to the action of this force, the fluid will issue at the point B with a velocity due to the height EB.

At the commencement of an open canal there is no exercise of pressure on the entering fluid, while there usually is a pressure at the head of the pipes. For example, if we bring the pipe AB down to CD, we shall have at C a force of pressure, in consequence of which the water will enter into the pipe with a velocity due to the height AC. According to the first principles of accelerated motion, this velocity should be added to that which the fluid acquires from the effect of the slope from C to D; so that, every obstacle being removed, it will issue with a velocity due to AC + FD, or to ED, the height which represents the force, in virtue of which the flow tends to take place.



In every other respect this case may again be compared to that of a canal; if we prolong CD up to G, level with the surface of the reservoir, and make a canal from G to D, the water will still tend to run out with a velocity due to ED. Thus, in both cases, in pipes as well as in canals, the accelerating force and the effects which it tends to produce are the same.

Under the influence of such a force the motion in pipes should be continually accelerated; and yet, at a very short distance from their origin, it is perceptibly uniform. There must then be, beyond that distance, an opposing force which continually destroys the effect of the former. This opposing force can only be the resistance of the sides of the pipe; a resistance which, as in a canal, arises from the adherence of the fluid particles to these sides and amongst each other.

Thus in pipes we have the same accelerating and retarding forces as in canals; the motion therein is of the same nature; and we may say that pipes differ but in one point from canals—that of having the upper part of the channel closed.

Meanwhile this difference in the form of the channel gives rise to peculiar circumstances in the movement, which demand special consideration; they will form the subject of this chapter.

Art. I.—OF SIMPLE CONDUITS.

In hydraulics, and particularly in connexion with water works, the name of *conduit* is given to a long series of pipes joined exactly one to another. The conduit is called *simple* (in opposition to a *system of conduits)* when it consists of only a single line of pipes, conducting to its extreme end all the water it receives at its origin.

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* g being velocity acquired from force of gravity in 1 second = 32·19 feet, lat. of London. p being rate of slope, or fall ÷ length.

1. STRAIGHT CONDUITS OF UNIFORM DIAMETER.

Manner of Expressing the Resistance.

2. For greater simplicity, let us unite in one the two forces which tend to produce the velocity of flow—the pressure AC at the head of the conduit, and that of FD which arises from the slope;—for this purpose let us imagine that the given conduit CD is placed horizontally at HI, at the bottom of a reservoir, of which the depth $AH = AC + FD = ED$. Nothing will be changed in the data of the problem; we shall have the same force and the same resistance, the latter being independent of the position of the conduit.

The force of pressure by reason of which the water tends to run out, or more immediately, the vertical height ED, which is the difference of level between the orifice of discharge and the surface of the fluid in the reservoir, is called the head *(charge de la conduite.)* We shall designate it by H.

If the conduit offered no resistance to the motion, setting aside the effect of contraction at the entry, the water would run out with a velocity due to this total height, as we have just seen. But it is not so; the resistance of the sides opposing an obstacle diminishes this velocity; it consequently absorbs a portion of the motive head H. The flow takes place only by virtue of the remaining portion, which portion is simply the height due to the velocity of discharge, or indeed to the velocity at any point of the conduit, since the motion therein is uniform, and the section everywhere the same.

Let v be this velocity, $\frac{v^2}{2g}$ will be the height due to the velocity or the effective portion of the head; $H - \frac{v^2}{2g}$ will then be the proportion absorbed by the resistance.

3. We have thus expressed, by the height H, the effort or the force of pressure which drives the water in the conduit; by the height $\frac{v^2}{2g}$ the force which produces the discharge; and by another lineal quantity $H - \frac{v^2}{2g}$, the resistance or negative force: although it is a principle in mechanics that forces of pressure, or efforts equivalent to weights, ought also to be expressed by weights. I will explain myself on this subject.

We have, in a former chapter, seen that the absolute pressure on a fluid horizontal plane, or portion of that plane, designated by s, was $psH^{\text{lbs.}}$, p being the specific gravity of the pressing liquid. Since, according to the laws of hydrostatics, the pressure is equal on every part of this plane, it will be sufficient, and at the same time convenient, to consider but one part only; this will be an infinitely small one, which we may suppose always of the same area; then s being constant, the pressure will vary only with the specific gravity or the nature of the liquid, and the *height* of its column; it is in this sense that we say that the height of the column of mercury in the barometer expresses the pressure of the atmosphere. If the pressing liquid remain the same, (as will be always the case with water in this chapter,) we may also pass over its weight p, which is constant; and the pressure will be expressed simply by H, and will be exclusively proportional to it.

If we were rigorously to adhere to the principle, we should regard H as the weight of the fluid filament which presses and drives on in the conduit the molecule which is immediately beneath it; and we should represent it by a line, as in elementary statics we represent by lines forces which are also weights.

Amount of the Resistance—Fundamental Equation.

4. Since the resistance arises from the effect of the sides, it will be proportional to their superfices—that is to say, to the length of the conduit, and to the circumference of its section, which is here the wet perimeter; for we are supposing that the flow is made in a full pipe, otherwise we should have the case of a simple canal. In other words, the more the section is enlarged the more also will the resistance of the sides be distributed among a greater number of molecules; consequently it will less affect each of them and the total mass; it will be in inverse ratio to their number, and consequently to the magnitude of the section. In short, here, as in canals, it will be proportional to the square of the velocity plus a fraction of the simple velocity.

Then, if L be the length of the conduit, S its section, C the wet contour or perimeter, a and b two constant coefficients, the expression of the resistance will be

$$a\frac{\mathrm{CL}}{\mathrm{S}}(v^2+bv).$$

And we shall have

$$\mathrm{H}-\frac{v^2}{2g}=a\frac{\mathrm{CL}}{\mathrm{S}}(v^2+bv) \quad . \quad . \quad . \quad . \quad . \quad (\mathrm{I.})$$

5. It remains to determine the coefficients a and b. M. Prony, who was the first to undertake this task in an adequate manner, makes use, for the purpose, of fifty-one experiments made by our most able hydraulicians, and which Du Buat had before employed in the establishment of his formulæ. He has deduced therefrom,

$$a = \cdot 0003485; \qquad b = \cdot 0498;$$

or, in the value of English feet, $a = \cdot 0001062$; $b = \cdot 13339$.

Of these fifty-one experiments, eighteen had been made by Du Buat himself, upon a tin pipe, of 1·063 inches diameter and 65·6 feet long; twenty-six had been made by Bossut, on tubes also of tin, 1·06 inches, 1·42 inches, and 2·13 inches diameter, and whose lengths varied from 31·95 feet to 192 feet; lastly, seven had been made on the large conduits in the park at Versailles, one was 5·3 inches diameter and 7478 feet long, and another 19·3 inches diameter and 3834 feet long.

Twelve years afterwards, Eytelwein treated anew the question of the motion of running waters; he has thought it right to take into consideration the contraction of the vein at the entrance of the conduit, and m being the coefficient for this contraction, he determined, (the measures being in metres,)

$$\left.\begin{aligned} & H-\frac{v^2}{2g\times m^2}=\cdot0002803\,\frac{CL}{S}\,(v^2+\ \cdot084\,v) \\ \text{Or in English feet,}\quad & H-\frac{v^2}{2g\times m^2}=\cdot0000854\,\frac{CL}{S}\,(v^2+\cdot2756\,v) \end{aligned}\right\}\ \ldots\ \text{(II.)}$$

But m, whose effect, besides being imperceptible in large conduits, is included in the value of a, given by the experiments. Consequently, and paying regard only to the most exact observations, and especially to those of Couplet, I shall adopt the equation,

$$\left.\begin{aligned} \text{[In metres]}\quad & H-\frac{v^2}{2g}=\cdot0003425\,\frac{CL}{S}\,(v^2+\ \cdot055\,v) \\ \text{[In English feet]}\quad & H-\frac{v^2}{2g}=\cdot0001044\,\frac{CL}{S}\,(v^2+\cdot18045\,v) \end{aligned}\right\}\ \ldots\ \text{(III.)}$$

For *canals*, the equation is

$$\left.\begin{aligned} \text{[In metres]}\quad & H-\frac{v^2}{2g}=\cdot0003655\,\frac{CL}{S}\,(v^2+\ \cdot066\,v) \\ \text{[In English feet]}\quad & H-\frac{v^2}{2g}=\cdot0001114\,\frac{CL}{S}\,(v^2+\cdot21654\,v) \end{aligned}\right\}\ \ldots\ \text{(IV.)}$$

These two equations are similar and very nearly the same, as should be the case. The slight differences in the numerical coefficients probably arise from errors in the observations. If this be so, as the observations are capable of being made with much greater exactness upon conduits than upon canals or rivers, it may be presumed that the coefficients of the equations for conduits are the more correct.

6. The section of pipes being a circle, if D represent the diameter, we shall have $S=\pi' D^2$, and $C=\pi D$; and by putting for π, π', and g, their numerical values,* the fundamental equation for the motion of water in conduit pipes will become,

$$\left.\begin{aligned} \text{[In metres]}\quad & H-\ \cdot051\,v^2=\ \ \cdot00137\,\frac{L}{D}\,(v^2+\ \cdot055\,v) \\ \text{[In feet]}\quad & H-\cdot0155\,v^2=\cdot0004176\,\frac{L}{D}\,(v^2+\cdot18045\,v) \end{aligned}\right\}\ \ldots\ \text{(V.)}$$

The velocity is very rarely among the quantities given or required in the problems to be resolved; the discharge is the quantity more frequently sought. Let Q be the volume discharged in a second: we have

$$Q=\pi' D^2 v;\qquad \text{or } v=1\cdot273\,\frac{Q}{D^2}\ \ \ldots\ .\ \text{(VI.)}$$

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* $\pi=3\cdot1416$; $\pi'=\cdot7854$.
$\frac{1}{2g}=\cdot051$ (in metres). $\frac{1}{2g}=\cdot0155$ (in English feet).

This value of *v*, put in the preceding equation, transforms it to

$$\left.\begin{aligned}&\text{[In metres]}\quad H - {\cdot}08264\,\frac{Q^2}{D^4} = {\cdot}002221\,\frac{L}{D^5}(Q^2 + {\cdot}0432QD^2)\\&\text{[In feet]}\quad H - {\cdot}02519\,\frac{Q^2}{D^4} = {\cdot}000677\,\frac{L}{D^5}(Q^2 + {\cdot}14173QD^2)\end{aligned}\right\}\;.\;.\;\text{(VII.)}$$

Such is the formula which we shall have to employ for the solution of questions relative to the motion of water in conduit pipes; attending always, in its practical application, to the observations which will hereafter follow. Of the four quantities Q, D, H, and L, three being given, the fourth may be found by this formula.

7. When the velocity is great, so as to exceed 2 feet per second, the resistance is sensibly proportional to the square of the velocity; the term in which it is but the first power disappears, and we have, according to the experiments of Couplet,

$$\left.\begin{aligned}&\text{[In metres]}\quad H - {\cdot}071\,v^2 = {\cdot}001435\,\frac{Lv^2}{D}\\&\text{[In feet]}\quad H - {\cdot}0155\,v^2 = {\cdot}0004373\,\frac{Lv^2}{D}\end{aligned}\right\}\;.\;.\;\text{(VIII.)}$$

Or, in terms of Q,

$$\left.\begin{aligned}&\text{[In metres]}\quad H - {\cdot}08264\,\frac{Q^2}{D^4} = {\cdot}002326\,\frac{LQ^2}{D^5}\\&\text{[In feet]}\quad H - {\cdot}02519\,\frac{Q^2}{D^4} = {\cdot}000709\,\frac{LQ^2}{D^5}\end{aligned}\right\}\;.\;.\;.\;\text{(IX.)}$$

It will be borne in mind that the second member of the above equations is the value of the resistance arising from the sides of the conduit.

8. Disengaging the value of Q from the general equation, it becomes

$$\left.\begin{aligned}&\text{[In metres]}\quad Q = -\frac{{\cdot}0216\,LD^2}{L+37{\cdot}2D} + \sqrt{\frac{450{\cdot}2\,HD^5}{L+37{\cdot}2\,D} + \left(\frac{{\cdot}0216\,LD^2}{L+37{\cdot}2D}\right)^2}\\&\text{[In feet]}\quad Q = -\frac{{\cdot}0709\,LD^2}{L+37{\cdot}2D} + \sqrt{\frac{1477{\cdot}06HD^5}{L+37{\cdot}2D} + \left(\frac{{\cdot}2325\,LD^2}{L+37{\cdot}2D}\right)^2}\end{aligned}\right\}\;.\;.\;.\;\text{(X.)}$$

In long conduits, where 37 D is very little compared with L, we may neglect it; and again neglecting the second term under the root, we shall have for ordinary cases of practice,

$$\left.\begin{aligned}&\text{[In metres]}\quad Q = 21{\cdot}22\,\sqrt{\frac{HD^5}{L}} - {\cdot}0216\,D^2\\&\text{[In feet]}\quad Q = 38{\cdot}4365\,\sqrt{\frac{HD^5}{L}} - {\cdot}0709\,D^2\end{aligned}\right\}\;.\;.\;\text{(XI.)}$$

9. In great velocities it is

$$\left.\begin{aligned}&\text{[In metres]}\quad Q = 20{\cdot}73\,\sqrt{\frac{HD^5}{L+35{\cdot}5\,D}};\ \text{or, } Q = 20{\cdot}3\,\sqrt{\frac{HD^5}{L}}\\&\text{[In feet]}\quad Q = 37{\cdot}034\,\sqrt{\frac{HD^5}{L+35{\cdot}5\,D}};\ \text{or, } Q = 36{\cdot}77\,\sqrt{\frac{HD^5}{L}}\end{aligned}\right\}\;.\;.\;\text{(XII.)}$$

If the velocity is required, we obtain its value by dividing the quantity Q by the section $\pi' D^2$.

Expression for the Diameter.

10. The diameter of conduits is very often the quantity we have to determine. The best method of obtaining it is by putting the fundamental equation under the following form:

$$\left.\begin{array}{ll}\text{[In metres]} & D^5 - \left\{ {\cdot}00009594\,\frac{LQ}{H} D^2 + {\cdot}0826\,\frac{Q^2}{H} D + {\cdot}00222\,\frac{LQ^2}{H} \right\} = 0 \\ \text{[In feet]} & D^5 - \left\{ {\cdot}00009594\,\frac{LQ}{H} D^2 + {\cdot}02518\,\frac{Q^2}{H} D + {\cdot}000677\,\frac{LQ^2}{H} \right\} = 0 \end{array}\right\} \text{(XIII.)}$$

We may pass over, for a first approximation, the first two terms in the brackets, and we have,

$$\left.\begin{array}{ll}\text{[In metres]} & D = \sqrt[5]{{\cdot}00222\,\frac{LQ^2}{H}} = {\cdot}295\,\sqrt[5]{\frac{LQ^2}{H}} \\ \text{[In feet]} & D = \sqrt[5]{{\cdot}0006769\,\frac{LQ^2}{H}} = {\cdot}2323\,\sqrt[5]{\frac{LQ^2}{H}} \end{array}\right\} \quad . \; . \quad \text{(XIV.)}$$

The value will be rather small; and we must successively make slight augmentations to it, until the first member of the equation is reduced to, or equals, 0. The quantity which shall have led to this result will be the diameter required.

For velocities above 2 feet per second, we may take directly and simply,

$$\left.\begin{array}{ll}\text{[In metres]} & D = {\cdot}298\,\sqrt[5]{\frac{LQ^2}{H}} \\ \text{[In feet]} & D = {\cdot}235\,\sqrt[5]{\frac{LQ^2}{H}} \end{array}\right\} \quad . \; . \; . \; . \quad \text{(XV.)}$$

I need say nothing on the determination of H and L; the equation (VII.) gives them by a simple transposition.

11. Let us take some examples of the determination of discharges and diameters:—

Ex. 1.—We have a conduit of (·25 metr.) ·820225 feet diameter, and (1450 metr.) 4757·3 feet long: required the volume of water it will discharge per second, with a head of (5·32 metr.) 17·454 feet?

We have here D = ·820225 feet; H = 17·454 feet; L = 4757·3 feet; and L + 37·2 D = 4787·816 feet. Consequently (X.),

$$Q = -\frac{{\cdot}0709 \times ({\cdot}820225)^2 \times 4757{\cdot}3}{4787{\cdot}816} + \sqrt{\frac{1477{\cdot}06 \times 17{\cdot}454 \times ({\cdot}820{\cdot}225)^5}{4787{\cdot}816} + \left(\frac{{\cdot}2325 \times 4757{\cdot}3 \times {\cdot}820225^2}{4787{\cdot}816}\right)^2}$$

$$= -{\cdot}047376 + \sqrt{1{\cdot}9989 + {\cdot}024155}$$
$$= -{\cdot}047376 + 1{\cdot}423 \quad = \quad 1{\cdot}37924 \text{ cubic feet per second,}$$

the quantity required (all the measures being in English feet). The simplified formula (XI.) would have given

$$Q = 1{\cdot}4185 - {\cdot}04767 = 1{\cdot}3708 \text{ cubic feet.}$$

That for great velocities (XII.), and applicable to this case, in which the velocity is 2·6 feet per second, would have given 1·357 cubic feet.

Ex. 2.—Required the diameter of a conduit, 2483·64 feet (757 metr.) long, and which shall convey 3·14317 cubic feet (·089 metr. cub.) per second, with a head of 3·2809 feet (1 metr.)?

Putting these numerical quantities in the equation (XIII.) it becomes, all reductions made,

$$D^5 - ({\cdot}22827\, D^2 + {\cdot}075811\, D + 5{\cdot}0604) = 0.$$

Neglecting the first and second terms, we have

$$D = \sqrt[5]{5{\cdot}0604} = 1{\cdot}383 \text{ feet.}$$

This value of D, put in equation (XIII.) will be found too small; by gradually increasing it, we shall find, by a few trials, that the value 1·4127 feet for D will reduce the first member of the equation to 0, and will be the diameter sought.

The formula for great velocities (XV.), and in this case v exceeds 2 feet per second, would have given

$$D = {\cdot}235 \sqrt[5]{\frac{2483{\cdot}64 + (3{\cdot}143)^2}{3{\cdot}2809}} = 1{\cdot}383 \text{ feet.}$$

[We shall next month proceed to the author's consideration of conduits terminated by adjutages.]

On Artificial Breakwaters and the Principles which Govern their Construction. By MR. A. G. FINDLAY.[*]

This paper commenced by stating that it was not wished to pronounce on the feasibility or impracticability of any of the numerous plans which have from time to time been proposed for the construction of breakwaters, but to submit some facts, drawn from natural effects, showing the forces to which such structures must be subjected. The paper, therefore, was naturally divided into two parts:—the first, which related to the action of the waves, and its collateral subjects; and the second,—which was postponed for a future evening, and which will relate to the various forms that have been given to sea-barriers, and the history of the progress of those now in existence.

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[*] From the London Athenæum, for February, 1850.

The principal difficulty in establishing a fixed breakwater was shown to be the enormous force of the waves. The form and nature of sea-waves generally were alluded to, and Mr. Scott Russell's system was described. Of the dynamic force exerted by sea-waves, it was stated that their greatest force was at the crest of the wave before it breaks; and its power in raising itself was measured by a number of facts. At Warberg, in Norway, it rose 400 feet, January 21, 1820; on the coast of Cornwall it rose 300 feet in 1843. Other examples, as the singular "souffleur" at the Mauritius, &c., were cited, showing that the waves have raised a column of water equivalent to a pressure of 3 to 5 tons per square foot, a result in accordance with Mr. T. Stevenson's observations with the marine dynamometer,—which was described.

It was shown by a table that the velocity of waves was dependent on their length; that waves of 300 to 400 feet in length from crest to crest, traveled with a velocity of 20 to 27½ miles an hour, and this whether they were 5 or 54 feet in total height; this velocity alone, should they become primary waves of translation, would give them a great percussive force. That waves travel very great distances was instanced by several facts. That they are raised by distant hurricanes and gales was noticed by their being felt simultaneously at St. Helena and Ascension, though 600 miles apart; and opinions quoted that these rollers, or ground swell, at times originated near Cape Horn, 3000 miles distant; rendering it more than probable that tropical hurricanes will send storm waves to our own shores. That it was not only at their surface that waves exerted great power, but that they reach in their action to the depth of eight fathoms and upwards, was shown by the operations for the recovery of the treasure from H. M. S. Thetis, which was wrecked and sunk at Cape Frio, Brazil, in 1831. The diving bell was swung 4 or 5 feet laterally, in calm weather, in these operations, much increasing their danger. Besides this, the guns and treasure were found covered by masses of rock of from 30 to 50 tons weight, moved by the action of the water, and weighed or turned over in the second operations by Capt. De Roos.

From these facts, it was considered that floating breakwaters generally were not adapted to combat with the waves. Admiral Tayler's plan of timber frame-work sections, Capt. Groves's iron cylinders with an attached grating, Capt. Pringle's frame, moored by its lower edge, Capt. A. Sleigh's floating sea barrier, Mr. Smith's plan, as submitted to the Society, were mentioned; and it was considered that the calculations of their resistance were understated,—that Admiral Tayler's section, instead of 25 tons strain, might, if the waves exerted only one-third of their force as known, have to withstand upwards of 1000 tons. This probably caused the failure of Admiral Tayler's experiment at Brighton, and Capt. Groves's at Dover. Major Parlby's principle of the trumpet-mouth sea-weed was compared with the *fucus giganteus* of Dr. Solander, abundant on the Patagonian and Fuegian coasts, and 360 feet in length, which is carried under water in currents, and torn up, and chokes all the bays during storms.

The motion of shingle, an important consideration in establishing breakwaters, was shown to be governed by the direction in which the surf strikes the shore, and this is dependent on the direction of the wind. This, from fifteen years' observation by M. Nell de Bréauté, at Dieppe, was shown to be in the ratio of 229 days from western quarters to 132 days from eastern quarters, giving that preponderance to its eastward progress. The mode in which it was arranged on the sloping beach in the form of a paraboloidal curve was explained.

Sand, a more powerful agent than shingle in changing the character of a coast, was stated to be deposited by currents, thus rendering the eastern parts of the English Channel much more embarrassed by them than the western portion. The Goodwin Sands were cited as examples of the extent of accumulation and of the changeable character of sand deposits. The diagrams exhibited showed the progress of these alterations, and were drawn from perhaps the only authentic history we possess of the changeable character of a quicksand. The different periods, from Græme Spencer's survey in 1795, down to Capt. Bullock's in 1850, showed that they had shifted miles in their position and area; evidently refuting the practicability of any principle which would apply to fixing them, and rendering them available more perfectly for breakwater purposes, as was proposed by Capt. Vetch, R. E., to the Royal Commission, 1845.—*Trans. Soci. Arts, Jan.* 23, 1850.

The Alp Tunnel.[*]

Its northern entrance is to be at Modane, the southern at Bardonneche, on the Mardovine. The latter entrance, being the highest point of the line, will be 4092 feet above the level of the sea, and yet 2400 feet below the culminating point of the great pass over Mont Cenis. The connecting lines leading to either entrance of the tunnel will be eight inclined planes of about 5000 metres, or 2½ English miles, each, worked like those at Liege, by endless cables and stationary engines, but moved by water power from the torrents. The tunnel itself will measure 12,290 metres, or nearly 7 English miles in length; its greatest height will be 19 feet, and its width 25. A most remarkable part of the project is the newly devised machinery and motive power by which the Chevalier Maus proposes to bore it. This machinery is said to be as ingenious as it is new, presenting, as a correspondent of the Times states, some extraordinary facts in mechanics which could hardly have been anticipated. In comparison with such a gigantic undertaking as this, the Thames Tunnel and the Britannia Bridge become secondary objects. An application for funds to begin with will be made to the Piedmontese Parliament forthwith, and the work, which it is expected will occupy five years, will cost 14,000,000f.; while the entire railway of the Alps, connecting the tunnel with the Chambery Railway on the one side, and with that of Susa on the other side, (in length together 36,565 metres, or 20¾ English miles,) will cost 21,000,000f. more, forming a total expense of 35,000,000f.

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[*] From the London Builder, No. 376.

AMERICAN PATENTS.

List of American Patents which issued in March, 1850, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Invalid Bedsteads;* Alexander W. Barker, Suffolk county, Massachusetts, March 5.

Claim.—"What I claim as my invention, is the combination of the inclining frame with the back seat, foot frames, and main bedstead, substantially in manner as specified."

2. For an *Adjustable Cord Hook for Door Springs;* William B. Barnard, Bristol, Hartford county, Connecticut, March 5.

The patentee says,—"The principle of my door spring is to combine with a coiled spring, acting on a fuse, an adjustable sliding or movable cord-hook, which shall act to close the door with more or less energy, according to the requirements of the season, the state of the wind, or other circumstances. The door is also so acted on by my spring alone, as to be held in its place when closed with more force than is exerted to commence closing it when wide open. The action of my sliding cord-hook is such that it co-operates with the form of the fuse, to diminish or increase the power of the spring to close the door, according as it is placed in one or another position to which it may be transferred."

Claim.—"What I claim as new, is the use of the adjustable cord-hook, or attachment for the cord, whereby the tendency of the spring to close the door is made to vary at pleasure, as set forth.

"I also claim, in combination with the spring and fuse, having the diminution of the diameter of the coils on the fuse more rapid than the decrease of elasticity in the spring by uncoiling the movable cord attachment, whereby the tendency of the spring to close the door is varied more rapidly than would be due to the simple change of position of the hook alone, in the manner and for the purposes set forth."

3. For an *Improvement in Machinery for Planing Slats for Window Blinds;* George Bonwill, Kent county, Delaware, March 5.

Claim.—"What I claim as my invention, is the engaging and disengaging the propelling slide block and carriage, by the combined action and connexion of the dart-holder, springs, and expander."

4. For a *Fastening for Hay and Manure Forks;* Alinzor Clark, Southfield, Richmond county, New York, March 5.

The patentee says,—"The nature of this invention consists in forming a mortise or slot in the metallic ferule inserted on the end of the handle of the hay fork, and in the handle itself, and bending steel bars to the usual form of the tines or prongs of hay and manure forks, and inserting them through said mortise or slot, so that they will assume a position in relation to the handle similar to the tines or prongs of the ordinary implements, and securing them in said mortise or slot by a key driven into the same."

Claim.—"What I claim as my invention, is forming the tines or prongs of the hay fork, and the additional tines or prongs which convert the same into a manure fork, out of single bars of steel, bent to the desired form, and securing the same to the handle by inserting them through the slot or mortise in the same, and driving keys or pins behind the same, substantially as set forth."

5. For an *Improvement in Carriage Jacks;* Thomas G. Clinton, George H. Knight, and Edward H. Knight, Cincinnati, Ohio, March 5.

The patentees say,—"The nature of our invention consists in enabling the rack to be lowered without resorting to such a series of slow and troublesome operations as those aforementioned, and this we effect by a combination of parts which are so devised that the tooth of the catch is released and then removed from its field of action by throwing down the lever which is thus and first take the load, then retract the catch, and then, by cams suitably located on the under side of the lever, bring adequate friction to bear upon ways cast on each side of the teeth of the rack, against which friction or resistance the load forces its descent and gradually falls home."

Claim.—"What we claim therein as new, is constructing the lever, or its equivalent, with teeth, prongs, and cams, or their equivalents, in such juxtaposition, the one with regard to the other, that when it is necessary to release the rack from its load, these parts of the lever appropriately unite in action with the teeth and the ways of the rack, or their equivalents, and with the pendants and the tooth of the catch, or their equivalents, to take the load off and release the catch, retract and make the frame of the catch a fixed point of resistance for the prongs of the lever, force out the lever-tooth from the rack-tooth, (the cam the while putting pressure upon the ways of the rack,) and oppose by the cams the requisite friction, and consequently resistance, to the descent of the rack; the whole being arranged substantially in the manner and for the purpose set forth."

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6. For an *Improvement in Firing Kilns for Pottery Ware, Black Lead Crucibles, &c.*, Jos. Dixon, Jersey City, New Jersey, March 5.

The patentee says,—"My invention consists in substituting rosin for the kinds of fuel heretofore used for these purposes, the distillation of which readily, and at a low temperature, evolves a great quantity of highly inflammable gas, which, in an inflammable or inflamed state, extends through all the parts of the kiln, giving an equal, or nearly equal, heat throughout that will bake equally, while at the same time it contains more carbon than the supporter of combustion can take up in passing through the flues of the kiln formed by the ware, and thus prevents the injurious action of the heated oxygen on the surface of the ware, particularly when baking black lead crucibles."

Claim.—"What I claim as my invention, is the use of rosin, or the distillation thereof, as a combustible for baking pottery and all other kinds of earthern ware, substantially as described, as a means of preventing such articles from being 'over-fired' or 'slack-burned,' and whereby, also, the injurious action of atmospheric air on the surface of black lead crucibles, pottery ware, bricks, &c., is avoided as described."

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7. For an *Improvement in Looms for Figured Fabrics;* Samuel Eccles, Kensington, Philadelphia county, Pennsylvania, March 5; anté dated December 22, 1849.

The patentee says,—"The first part of my improvement consists in the mode of working the picking motion.

"The second part of my invention consists of a series of small plates, in combination with the motions which act with them, for the purpose of determining the movement of the shuttle-boxes.

"The third part of my invention consists in the apparatus, hereafter described, by which the boxes are moved, and are held in their respective positions whilst the pick is being made."

Claim.—"I claim as my invention, 1st, obtaining the picking motion, or (otherwise expressed) giving action to the picking shaft, by means of the shaft carrying the picking fingers oscillating with the lay, in combination with the mode of raising and depressing the fingers by the combination of the cam and lever, the said cam being detached from the other parts of the loom, thereby enabling it to be easily changed in the manner and for the purpose above specified.

"2d, I claim the pattern plates, made and worked in the manner and for the purpose herein fully made known, in combination with the pattern levers, with the pins fixed in them, the lever and cam for the purpose of lifting said pattern levers, the star-driver and the star-plate, the mitre wheels, shaft, and bevel wheels, in combination with the cylinder; the respective motions herein referred to being carried on or effected substantially in the manner and for the purpose herein fully made known.

"3d, I claim the combination formed by the mechanism for moving the shuttle-boxes: that is to say, the cam, lever, and pulling catches, together with the bevel wheels and intermediate bevels k^1 and k^6, together with the star-driver L, and star-plate L^1 and pinion, and the shaft k^7, bevels L^2 and L^3, together with the star-driver M^1, and star-plate M^2; said bevels, shaft, star-drivers, and stars, oscillating with the lay, and acting from the same centre, so that the connexion between the shuttle-boxes and bevels is never broken or detached; the whole being constructed and arranged in the manner and for the purpose herein fully described I do not limit my claim to the precise arrangement herein set forth, nor to the movement of any description of shuttle-boxes; but I do claim my combination of motions used for the purpose of moving shuttle-boxes of any description, when such arrangements and combinations are substantially the same with that herein described.

"4th, I claim the apparatus for holding the pins in star-driver L, and the pins in bevels

$k^{2\,3\,4}$ and ^{5}, and consequently the shuttle-boxes connected therewith in a proper position; or more particularly the lever and rod connected with the bracket or carrier; and the action to said lever being given by the oscillation of the lay, in the manner and for the purpose herein specified."

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8. For an *Improved Apparatus for Registering the Depth of Water in Vessels' Holds;* Nelson Edwards, Chittenden county, Vermont, March 5.

Claim.—"What I claim as my invention, is the combination of the secondary index hand apparatus with the primary index hand apparatus, or that which denotes the depth or rise of water; the secondary index hand apparatus being for the purpose of registering the extreme depth as above stated."

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9. For *Improvements in Machinery for Dressing Hemp and Flax;* William W. Grant, Providence county, Rhode Island, March 5.

Claim.—"What I claim is the combination of the toothed cylinder, the wind passage, the trunk, the endless apron, the set of feed rollers, the concave, and the waste apron; the whole arranged and made to operate together substantially in the manner and for the purpose as set forth.

"And, in combination with the feed apron, its roller and toothed cylinder, I claim the protecting shield, the same being for the purpose of protecting the apron from injury and wear as specified; also to protect the journals of the rollers from winding up with waste or lint."

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10. For *Improvements in Railroad Cars;* George S. Hacker, Charleston, South Carolina, March 5.

The patentee says,—"The principle of my invention consists in supporting each end of the platform of the car, and connecting it by turning joints with a secondary platform, which secondary platforms are in turn supported near each end on, and connected each by turning joints with, two four-wheeled trucks; whereby I am enabled to make railroad cars of much greater length than heretofore, whilst at the same time they are better adapted to run on curves with safety, and the lateral and vertical vibrations given to the wheels do not produce so great an effect on the body of the car."

Claim.—"What I claim as my invention, is supporting and connecting both ends of the main platform of a railroad car each with the centres of secondary platforms, which secondary platforms are connected at each end with, and supported each on, four-wheeled trucks, all substantially in the manner and for the purpose specified."

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11. For an *Improvement in Corn Ploughs;* Robert J. King, Lancaster, Lancaster county, Pennsylvania, March 5.

Claim.—"What I claim as new, is the movable expanding wings, combined and moved substantially in the manner and for the purpose herein described, by means of right and left screws on a cranked shaft, that can be turned whilst the plough is in motion."

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12. For *Improvements in Cooking Ranges and Air-Heating Furnaces connected therewith;* James McGregor, Jr., City of New York, March 5.

The patentee says,—"The object of the first part of my invention is to produce in the ovens of ranges, and other like articles, a constant circulation of hot air.

"The second part of my invention relates to the top and boiler holes of ranges and stoves, and consists in so constructing the contractors as that any two of the direct boiler holes may be changed into one of the same size as either one of the two, and the single boiler hole thus produced brought directly over the fire. When, by the same arrangement, four boiler holes are reduced to two, they are also brought directly over the centre of the fire, or nearly so.

"The third part of my invention has for its object to prevent the breaking of the side of the ranges and doors by falling, when not securely fastened up, and consists in attaching a spring support to the side of the range immediately below the hinge of the door, to receive and sustain it when it is allowed to fall, the elasticity of the support preventing the breaking of the door or side of the range by concussion.

"The fourth part of my invention relates to the warming of the rooms of a house by the waste heat from the range, and providing a damper from the hot air flue or reservoir which, when open, will allow all the heated air to ascend out of the flue, and cause a current of air to pass from all rooms connected therewith, when the register or registers are opened in the said room or rooms, leading to the hot air flue, more particularly when the cold air flue is closed by the damper."

Claim.—"What I claim as my invention, is, 1st, equalizing the heat in the oven by allowing the air to circulate and ascend through the chamber between the fire box and the front oven plate, for the purpose substantially as set forth.

"2d, I also claim so constructing the contractors that two of the boiler holes may be changed into one of the same size as either of the other two, by which means a boiler hole may be had directly over the centre of the fire, or four boiler holes reduced to two, all being of the same size, as described.

"3d, I claim, in combination with the air-heating apparatus, the disposition or arrangement of the valves with either of the valves on the door, for the purpose of ventilation as described; the position of the valves is not material, so that their combined operation shall be as set forth."

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13. For an *Improvement in Air-Heating Furnaces;* James McGregor, Jr., Wilton, Saratoga county, New York, March 5.

The patentee says,—"My improvements consist, 1st, in forming on the inside of each segment of the cylinder, and at each seam or joining of the plates or staves composing the cylinder, a semi-cylindrical or other formed tube, to be filled with sand to form sand lutes, which will render the joints air-tight, and thus prevent the escape of smoke and other gases; and second, in separating the fire pot from the air chamber by a partition, and suspending it to the bottom of the heating chamber, by providing the upper edge of the fire pot with a horizontal flanch fitted to corresponding grooves in the bottom of the heating chamber, so that the fire pot can be pushed in and out with facility."

Claim.—"What I claim as my invention, is, 1st, making the heating chamber in sections, in combination with the segments of tubes or vertical cavities, cast on the plates at the laps, containing sand, substantially as described, whereby they are rendered air tight.

"2d, I claim the mode of fastening the handle to the grate, and keeping the grate true with the handle, by means of the bolt by which they are connected with the two studs, as substantially set forth.

"3d, I claim the separate chamber for the fire pot, which is suspended below the chamber of combustion, to prevent the air heated by the fire pot from entering into the air chamber surrounding the heating cylinder, for the purpose and in the manner as substantially set forth.

"4th, I claim admitting air and flame through the pipe, and its aperture or apertures, into the chamber of combustion and radiation, in the manner and for the purpose substantially as set forth.

"5th, I also claim this mode of introducing the heated air and flame, in combination with the descending draft, as described."

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14. For an *Improvement in Cooking Stoves;* Charles M. Nelson, Cincinnati, Ohio, March 5.

The patentee says,—"The nature of my invention consists in combining with the sliding register, at the back of the fire chamber, a pivoted valve or damper arranged above the said register, which will admit all the heat, or part, at pleasure, to pass over the oven or under it, according to the position of said register and valve."

Claim.—"What I claim as my invention, is the arrangement of the valve or damper above the back plate of the fire chamber, in combination with the register, for regulating the draft, as herein fully set forth."

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15. For an *Improvement in the Composition for Enamelling Hollow Ware;* C. E. & C. H. Paris, Paris, France, March 5; in England, January 23, 1849.

The patentees say,—"Our invention consists of a new and useful composition for coating articles made of either wrought or cast iron, so as to keep off the atmosphere, and other fluids and matters which would cause the iron to oxidize. The composition consists of 130 parts of flint glass reduced to powder, 20½ parts of carbonate of soda, and 12 parts of boracic acid. These matters, being intimately mixed, are to be placed in a glass-maker's crucible and melted; the same is then to be drawn off and cooled, and then broken down into fine powder."

Claim.—"What we claim is the new and useful glazing composition for coating articles of iron to prevent oxidation, substantially as specified."

16. For an *Improvement in Apparatus for Retaining Cars on the Rails;* William Payne, City of New York, March 5.

The patentee says,—"My improvement consists in the invention of a certain apparatus to be applied to, and combined with, the trucks of cars of locomotives, tenders, freight and other carriages running upon railways, which apparatus has for its object the prevention of accidents from the said trucks or cars being thrown or dislodged from the rails by any obstacle in the way of the free passage of the burthen wheels over them."

Claim.—"What I claim as my invention, is combining the trucks or other suitable parts of locomotives, freight and passenger cars, with the rails, by means of two bars, one vertical and one horizontal, connected in such way that oscillations and other vibratory movements of said cars will be permitted without disengaging the hoods or rollers attached to the lower ends of the vertical bars from the flanch of the rails; the whole being arranged substantially in the manner described herein."

17. For *Improved Winged Metallic Cartridges;* Alonzo D. Perry, City of New York, March 5.

The patentee says,—"My improvements relate to that class of cartridges or loaded balls in which the ball is made cylindrical, with a spherical or pointed end, and the rear part hollow, to contain the charge of powder.

"The first part of my invention consists in slitting the rear end of the hollow part of the ball a given distance apart around the periphery, and in lines parallel or slightly oblique to the axis, so that after the charge of powder, with a gun cotton or other equivalent cap over it, has been inserted, the slitted parts can be bent in, overlapping each other to secure the charge, and which, when the ball is discharged from the barrel of a gun or other fire arm, will be spread out by the force of the discharge, and form spiral wings, to give a rotary motion to the ball to guide it in a straight line.

"And the second part of my invention consists in forming the forward end of the ball with a nipple, to which is fitted a percussion cap, so that when the ball strikes and enters a magazine, &c., the explosion of the cap may ignite the body struck, when this is used in combination with a ball having wings or other means of guiding and keeping the cap in front."

Claim.—"What I claim as my invention, is the method of enclosing the charge of powder in the hollow part of the ball, by slitting its rear end and bending in the parts so slitted, substantially as herein described, that, when the ball is discharged, the parts so slitted may be forced out to become feathers or wings to guide the ball, substantially as described"

18. For an *Improved Process in the Manufacture of Glucose;* George Riley, City of New York, March 5.

The patentee says,—"The nature of my invention consists in the making of a saccharine substance, known as glucose or grape sugar, from the meal of Indian corn, for fermenting and other purposes, by boiling the same under a pressure greater than that of the atmosphere in water acidulated with sulphuric acid."

Claim.—"What I claim as my invention, is the conversion of corn meal into a solution of grape sugar or glucose, by boiling the same under a pressure greater than that of the atmosphere in water acidulated with sulphuric acid, substantially in the manner described."

19. For an *Improvement in the Construction of Fire Places and Throats of Chimnies;* C. W. Russell, City of Washington, D. C., March 5.

The patentee says,—"The nature of my invention in constructing fire places and chimnies, and in altering those already constructed, to increase their draft and prevent them from smoking, consists in forming a flue in the centre of the back of the fire place, between the hearth and top of the back or horizontal off-set, extending horizontally from the fire place into the brickwork as far as the back wall of the chimney, and then perpendicularly to the top of said back, and opening into the space directly above the horizontal off-set, and centrally under the flue of the chimney, flaring to the right and to the left as it ascends, and at the same time becoming narrower in its cross-section, making the area of the outlet at the plane of the off-set lesser than the area of the inlet at the back of the fire place.

"And in connexion with the before described flue in the back of the fire place, the main flue of the chimney stack must be brought down to within nine inches from the bottom of the arch or breast of the fire place.

"And also, in connexion with the before described improvements, dropping the back of the fire place about two courses below the arch or breast forming the horizontal off-set before mentioned."

Claim.—"What I claim as my invention, consists in constructing chimnies with an additional flue in the back of the fire place, made in the manner and for the purpose herein fully set forth, in combination with the bringing down of the main flue of the chimney stack, as above described, with the horizontal off-set at the top of the back of the fire place, and the space at the sides, all as herein fully set forth."

20. For an *Improvement in Mail Axles;* William H. Saunders, Hastings-upon-Hudson, West Chester county, New York, March 5.

Claim.—"What I claim as my invention, is the making open grooves, of whatever form, cast or cut in or upon the large end of axle boxes, upon carriage axles technically known as mail axles, and upon axles for cars with short bolts, with whatever form of head fitted into the grooves, for securing the wheels and boxes upon such carriage axles, and upon cars, in the place of, and supersede, long bolts which are now in use for securing such wheels and boxes."

21. For an *Improvement in Cooking Ranges;* Frederick H. Stimpson, Boston, Massachusetts, March 5.

Claim.—"What I claim as my invention, is extending back the front boiler chamber or chambers, to form the back boiler chamber or chambers at the side or sides of the elevated oven, substantially as described, in combination with the partition or partitions at the side of the front boiler chamber or chambers, and extending back of the back boiler chamber or chambers, when the said partition or partitions is provided with flue holes at the side of the side boiler or boilers, and back of the back boiler or boilers, and leading to the flue around the elevated oven, substantially in the manner and for the purpose specified."

22. For an *Improvement in Chimney Caps;* Edward Whitely, Boston, Massachusetts, March 5.

Claim.—"What I claim as my invention, is the improved ventilator, constructed of a combination of a series of external plates, a series of internal plates, and openings or smoke passages, arranged, covered, and applied to a flue, and made to operate together, substantially in the manner as specified."

23. For an *Improved Scraper for Removing Snow from Ice;* Nathaniel J. Wyeth, Cambridge, Middlesex county, Massachusetts, March 5.

The patentee says,—"My ice scraper consists of a wooden frame of the form, in outline, nearly of an isosceles triangle, the surfaces of the two equal sides being beveled or chamfered off, so as to form an obtuse angle with the surface of the ice, and being faced with strips of iron for about half their width, the base of the triangular frame having at each end metallic guides, which fit into the grooves of the ice, formed as shown in fig. 1 and hereafter explained."

Claim.—"What I claim as my invention, is an ice scraper constructed substantially as above described: that is, in the form of a triangle, (so that in moving in either direction, the snow will be thrown by the diagonal sides at right angles to the course of the scraper,) and the base having guides which move in grooves formed in the ice, and control the motions of the implement, as herein above set forth."

24. For an *Improvement in Gas Metres;* James Long, Chicago, Illinois, March 5.

Claim.—"What I claim as my invention, is the use of the four mercurial valve cups, as described, for filling and discharging alternately the two measuring gasometers, as set forth.

"I also claim the shaft, in combination with the levers and pawl, for giving simultaneous movement to the hands of the dials, the valves, and the gasometers, as set forth."

25. For an *Improvement in the Spiral Spring Sash Stopper;* William B. Barnard, Bristol, Hartford county, Connecticut, March 12.

Claim.—"What I claim as my invention, is the combination with the ratchet or click, or any well known equivalent therefor, to arrest the action of the sash elevator, of the spring bolt for fastening the sash, thereby giving double security against any disturbance of the position of the sash, substantially in the manner and for the purposes set forth."

26. For an *Improvement in Cutting Figures in Relief on Wood;* John T. Bruen, City of New York, March 12.

Claim.—"What I claim as my invention, is the combination of an adjustable guide rack with an adjustable guide block, to produce the transverse in combination with the longitudinal motion, for the purpose of producing on wood or other material forms of a curvilinear, zig-zag, or mixed outline, substantially as set forth.

"I likewise claim the device for effecting the reversal of the shifting lever, constructed and arranged substantially as herein set forth, and composed essentially of the adjustable stops, springs, detents, vibrating frame, and wheels."

27. For *Fastening of Terrets in Harness Saddles;* P. B. Cool, Columbus, Ohio, March 12.

The patentee says,—"The nature of my invention consists in uniting a self-adjusting pad to one of the legs of a saddle-tree, and also to the terret, by means of a single joint, composed substantially in the manner hereinafter set forth."

Claim.—"What I claim as my invention, is the combination of an adjustable pad and a terret with each other, and with one of the legs of a harness saddle-tree, by means of a single joint, so constructed that neither the pad or the terret can be turned on their axes from their proper positions, substantially as herein set forth, to wit, by means of a rectangular opening in each leg of the saddle-tree, with lugs descending from its sides, for the reception of the shank of a terret, and by the ears rising from the upper side of a pad, that receive between them the end of the shank of the terret, through holes in which ears and terret shank the rivet passes, and holds the three parts securely together."

28. For an *Improvement in Ventilating Railroad Cars;* James Cunningham, Reading, Berks county, Pennsylvania, March 12.

The patentee says,—"My invention consists in attaching to one of the cars of a train a centrifugal fan which is driven from one of the axletrees of the car, the blast thus generated being conveyed through the car by pipes, whence it is discharged by adjustable adjutages of peculiar form in the direction required, to prevent the dust from entering the car."

Claim.—"What I claim as my invention, is the employment of jets of air, produced substantially in the manner herein set forth, for preventing the entrance of dust into railroad cars or carriages of any description."

29. For an *Improvement in Furnaces for Heating Sad Irons;* John T. Davy, Troy, New York, March 12.

The patentee says,—"The nature of my invention consists in combining with a portable furnace, of ordinary construction, a surrounding heating chamber provided with apertures or slots, combined with a flap or door at top, which will admit of inserting the body of the flat for the purpose of heating it, and leave the handles exposed to the cooling influence of the external air."

Claim.—"What I claim as my invention, is combining with a portable furnace of the usual construction, a surrounding heating chamber provided with apertures or slots, to admit of the insertion or removal of the flats, combined with the door or flap at top, substantially as described.

"I also claim providing the said air-heating chamber with a revolving top provided with a small door or flap, which, by the rotation, may be brought directly over the slots in succession, and the flats inserted or removed, substantially as described."

30. For an *Improvement in Coloring Photographic Pictures;* Aaron O. Dayton, City of Washington, D. C., March 12.

Claim.—"What I claim as my invention, is the application to photographic pictures taken upon paper, or upon transparent or translucent medium, of the mode of coloring I have described, or any other substantially the same, and which will produce a similar effect."

31. For *Improvements in Pumps for Deep Wells;* Nehemiah Dodge, City of New York, March 12.

Claim.—"What I claim as new, is the combination of the pump barrel, having a valve as described, with the water chamber at the bottom and the lever at the top, substantially as described, so as to raise the water by elevating and depressing the barrel, thereby dispensing with the ordinary piston and piston rod and avoiding the inconveniences incident thereto."

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32. For *Improvements in Machinery for Making Pill Boxes;* Asa Fessenden, Baldwinsville, Worcester county, Massachusetts, March 12.

Claim.—"What I claim is the above described peculiar arrangement of two or more sets of reducing cutters, applied to one carriage as above set forth, two or more sets of reducing cutters, applied to another carriage in a similar manner, feeding apparatus applied as above set forth to each cutting apparatus, and two circular saws playing between, and acting in concert with, the adjacent opposite cutting apparatus of both carriages; the whole operating together substantially as specified.

"I also claim the combination of machinery by which each of the circular saws, or their puppet heads or carriages, are alternately moved, first in one direction and next in the opposite direction, and on their supporting ways; the said machinery consisting of the arm affixed to the upright shaft, the slide, and its projecting pin applied to the end of the said arm, the grooved cam plate, the lever or arm, connecting-rod, the pin projecting from the under side of the carriage, and the springs; the whole being constructed and made to operate substantially in the manner and for the purpose as specified."

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33. For a *Cultivating Seed Planter;* William Flory and George A. Grove, Chambersburg, Franklin county, Pennsylvania, March 12.

Claim.—"What we claim as our invention, is the combination of the roller and the harrow, for crushing and pulverizing the soil, with the cultivator teeth for forming the furrows and depositing the seed, the roller preceding the harrow, and both preceding the cultivator teeth. as set forth."

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34. For an *Improvement in Air-Heating Stoves;* Perry Goodhue, Cincinnati, Ohio, March 12.

The patentee says,—"The nature of my invention consists in constructing stoves, or other similar structures, so that, the fire once lighted, the fuel shall be confined in a bowl or other shaped vessel, to which air can alone have access through perforations in the bottom of a cylindrical vessel, inserted within and of lesser diameter than the drum usually placed over the fire bowl for the purpose of radiating heat. The perforations being thus located, the jets of air are thrown down directly into the heart of the fire, and the flame is forced to lick the sides of the drum as it passes through the annular space between the air-jetter and the drum.

"I also pass a pipe through the fire, the pipe having an enlargement perforated for the purpose of throwing jets of air athwart the direction of the downward jets of air before mentioned, thus creating a commotion calculated intimately to commingle the downward and horizontal jets of air with the flame and gases of the fire; and also continuing the pipe through the aforementioned downward air-jetter, up to a reservoir located on the top of the drum, the reservoir having a perforated top, and thereby discharging the heated air into the domestic or other apartment."

Claim.—"What I claim therein as new, is inserting the vessel as described for throwing down jets of air directly upon the flame and other results of combustion, the cylindrical vessel being of less diameter than the drum, half-way up and within which it is placed, so that the flame and results of combustion are commingled with the jets of air and more thoroughly consumed, and are also forced to lick the sides of the drum, and thus cause the greatest possible radiation of heat.

"And in combination with the foregoing, I claim the pipe with its enlargement, and the reservoir, as described, for carrying a column of air through a pipe led through the heart of the fire, this pipe being enlarged about the level of the top of the fire bowl, so as to throw jets of air athwart the direction of the downward jets before described, and this pipe being also continued up to a reservoir on the top of the drum, through perforations on the top of which air-reservoir jets of heated air are continually thrown into the domestic or other apartment; by which general construction of this pipe I effect a complete commingling, consuming, and outward forcing of the results of combustion against the sides of the drum, and at the same time furnish to the apartment an agent for heating and keeping up an active circulation of the atmosphere in the room to which heat is to be imparted."

35. For an *Improvement in Regulators for Drawing Rollers;* Whiting Hayden, Windham, Windham county, Connecticut, March 12.

The patentee says,—"The nature of my invention consists in the application of a certain apparatus or combination of mechanical devices to the drawing frame, by means of which the speed of the rolls accomplishing the draft upon the sliver of cotton is regulated by the size of volume of said sliver of cotton itself, thus causing the work of the machine to be uniform and perfect as delivered by the rolls, and the apparatus to effect the same to be self-acting."

Claim.—What I claim as my invention, is the combination of the tube, lever, weight, jointed bar, oscillating shaft and pinion, gears, screw shaft, nut, arms, with their belt guides, belt, cones, shaft and bevel gears, for changing and regulating the speed of the rolls, for equalizing the drawing or making the sliver the required size, substantially as described."

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36. For an *Improvement in Oil Presses;* Edwin Hills, Cincinnati, Ohio, March 12.

The patentee says,—"My oil press is composed of a series of cases arranged above each other between the crown and base plates of a power press; each case is open at one end, for the introduction and withdrawal of the charge of the substance to be acted upon; the bottom of each case is also open for the entrance of a follower secured to the top of the one next below it.

"Each case is lined with plates of iron or steel. which are perforated to allow the escape of oil expressed from the substance within them, into channels formed in the sides of the case, whence it flows into a gutter formed on the upper side of the top of each case. These gutters collect the oil from the several channels and deliver it to the receptacle provided for the purpose. The press is constructed in such a manner that when the pressure is removed, the cases, descending by their weight are received upon rests provided for the purpose, which retain them in their proper position for discharging the spent materials and introducing a fresh charge."

Claim.—"What I claim as new, is, 1st, the construction and arrangement of a series of press cases, substantially as herein set forth, each box forming or carrying the follower of the one next above, and all being supported, when not in action, at suitable distances apart by the offsets on the guides.

"2d, The combination of the perforated lining plates with the grooves or channels on the interior of the press cases, substantially as set forth."

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37. For an *Improvement in Noddle-Irons for Saw Mills;* Gideon Hotchkiss, Windsor, Broome county, New York, March 12.

Claim.—"What I claim as my improvement in noddle-irons for saw mills, is the combination of the four-pointed knuckle with indented straps and screw tie-bolts; the whole constructed and arranged substantially in the manner and for the purposes set forth."

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38. For *Improvements in Looms for Weaving Piled Fabrics;* Elias Johnson, assignee of John Johnson, Troy, New York, March 12; anté dated March 19, 1849.

The patentee says,—"The first part of my invention, which relates to the forming of the piled or looped surface, consists in inserting the figuring wire or wires into the open shed of the warps, and withdrawing it or them from under the pile or figuring loops, by means of a carrier to which one end of the wire is attached, and which has a reciprocating motion from and towards the selvage, to withdraw and insert the figuring or looping wire, and also a motion towards and from the lathe of the loom, to carry the figuring wire from the woven part to the open shed of the warps preparatory to the insertion thereof, and then a back motion to carry the wire up to and against the woven part of the fabric.

"The second part of my invention consists in combining with the wire carrier a guide or support, through which the figuring wire passes, and in which it slides, when the said guide or support is operated to move in unison with the wire carrier towards and from the lay.

"The third part of my invention consists in forming the pile or loops on two wires introduced from opposite sides of the fabric, and which lap in the middle of the fabric, the ends being chamfered at the lap, whereby the inconvenience arising from the use of long wires in weaving wide fabrics is avoided.

"And the fourth part of my invention consists in so arranging the shuttle and harness motions as to omit one pick in the formation of every range of loops, that the lay may make one beat without throwing the shuttle or working the warps, to beat up the wire before the insertion of the filling or weft."

Claim.—"What I claim as my invention, is the method of inserting the figuring wire or wires into the open shed, and withdrawing the same from under the woven pile or loops by means of a carrier or carriers, to which one end of the figuring wire or wires is or are attached, when the said carrier or carriers is so operated, substantially as herein described, as to receive a motion from and towards the selvage of fabric to insert and withdraw the wire, and towards and from the lay to carry the wire to the open shed, and, when inserted, back against the woven part of the fabric, all substantially as described.

"I also claim combining with each carrier and figuring wire, a guide or support through which the wire passes, substantially as described, when the said guide receives a motion towards and from the lay in unison with the carrier, substantially as described.

"I also claim forming each range of figuring loops on two wires, introduced from opposite sides and overlapping in the middle, with the lapping ends chamfered or beveled, substantially as described."

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39. For an *Improvement in Cast Iron Car Wheels;* Lyman Kinsley, Norfolk county, Massachusetts, March 12.

Claim.—"What I claim as my improvement, is the wheel or combination of the arched support plate, the curved spokes or arms, and the curved plate with the solid or undivided hub, and the chilled rim, all cast together and in one piece, substantially as specified."

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40. For an *Improvement in Cast Iron Car Wheels;* Lyman Kinsley, Norfolk county, Massachusetts, March 12.

Claim.—"What I claim as my invention, is the wheel made with the chilled rim or hollow felloe, or a support plate extending around and within the chilled rim, a curved plate uniting the rim and hub, a series of curved arms, and an undivided or unsplit hub, all cast or founded, and combined together in one piece, substantially in manner as specified."

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41. For an *Improvement in the Interior Arrangement of Steam Boilers;* Sylvanus Knight, Winchester, Randolph county, Indiana, March 12.

The patentee says,—"The first part of my invention consists of contrivances for obviating the difficulties hitherto incident to steam boilers subject to great changes of position, such as those employed in locomotive steam engines on common roads, and in marine steam vessels.

The second part of my invention consists in arrangements for the more economical and effectual working of the stack."

Claim.—"What I claim as new, is the troughs surmounting diaphragms, (which separate the water space vertically into as many isolated chambers,) and having sides which rise higher towards the outside, in order to collect such water as overflows, and to distribute it among the several parts when the boiler recoils."

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42. For an *Improved Lever-Lewis;* Thomas Lidgerwood, Brooklyn, New York, March 12.

Claim.—"What I claim as my invention, is attaching a bent lever, having its foot resting against or hooking under one of the vertical sides of a stone, to that same vertical side of the stone, by any of the well known forms of lewis, substantially in the manner and for the purpose described."

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43. For an *Improvement in the Gauge for Water Casks;* Henry Schreiner, assignee of John Marquart, Jr., Reading, Berks county, Pennsylvania, March 12.

Claim.—"What I claim as my invention, is the combination of the joints or rods with the piece A C D, scale F, and piece B C D, in the manner set forth."

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44. For an *Improvement in Flouring Mills;* Alexander F. Menefee, Rappahannock county, Virginia, March 12.

Claim.—"What I claim as new, is the manner in which I have arranged and combined the spouts and tubes, and their slides, with each other and with the bottom of the chest, and with the boxed conveyors, by which complete control is obtained over the quality of the flour passed into the packing chest, and also to give a similar control over the quantity and quality of the flour carried from the chest into the conveyor L, to be returned through *f* to the flour elevators, substantially as described.

"I claim the manner in which I have arranged and combined spouts *k l*, pipes *b b*, &c., and their slides *c c c*, &c., with each other and with B F L, and M and O with F, and F with

G and H, by which the flour and bran are mingled in any desired proportions and passed together into H, so as to give complete control over the action and products of H, and to prevent the choking or filling up of the meshes of the bolting cloth, substantially as described.

"I claim also the manner in which I have combined spout *d* with the bottom of I and top of L, and *g* with the bottom of L and the burrs, so as to pass to the burrs such portions of the middlings as require re-grinding, substantially as described.

"And while I do not claim as my invention the separate parts of my bolting machinery taken individually, I do claim as new the manner of combining and arranging those parts substantially as before described, so that entire control is given over the process of bolting, and it is made one entire and continuous action and by machinery, by which any desired portion of the flour in the first bolting chests is passed through *i*, or through *i* and *j*, into the packing chest, and any portion thereof passed through *k* or *l* into L, and thence through *f*, with the flour from I through *e*, to the elevators, and any portion, at the miller's discretion, passed through *b b*, &c., into F.

"And the flour unbolted from M, the flour from *b b*, &c., and the bran from O, mingled and passed together in any proportions through G into I and H, and there thoroughly bolted and separated without any choking of the meshes of the bolt, the bran passed off through J, and the offal through *h*, in any required condition, the middlings forced through *d* into L, and from thence through *g* to the burrs to be re-ground, while the flour is forced through *e* into L, and, meeting with the flour passed into L from *l*, with it carried through *f* to the flour elevators."

45. For an *Improvement in Abdominal Supporters;* Mary W. O'Meara, City of New York, March 12.

The patentee says,—"The nature of my invention consists in providing an abdominal supporter composed of a bodice support for the abdomen, with the ribs projecting to the middle, and combining the same with section trunk hose, or short legs, to retain the bodice firmly in its place and prevent it from gathering or being raised up by the bodily action of the person who wears it."

Claim.—"I claim this abdominal supporter, constructed with the bodice as described, in combination with the trunk hose, in the manner described, or in any other manner substantially the same for the purpose set forth."

46. For an *Improved Method of Operating Lock Bolts;* Henry C. Jones, assignee of Thos. Slaight, Newark, New Jersey, March 12.

The patentee says,—"My invention relates to the construction of the lock for locking the switch, and consists in operating, by means of reciprocating slides, a vibrating lever provided with a bolt at one end, projecting from the back face of the lock, in combination with a spring guard-plate, provided with a notch, for the purpose of preventing the key from turning, and otherwise so formed as to prevent the withdrawal of the key unless the bolt is thrown. It is obvious that this lock is peculiarly adapted to the locking of switches on railroads, the lock being provided with a guard-plate to prevent the key from being withdrawn unless the bolt is locked."

Claim.—"What I claim as my invention, is operating, by means of reciprocating slides, a vibrating lever provided with a bolt at one end, and projecting from the back face of the lock, substantially as described."

47. For an *Improvement in Brakes for Carriages;* Wm. T. Welch, Jr., Churchville, Harford county, Maryland, March 12.

The patentee says,—"My improvements relate to the combination and arrangement of a suspended toothed or notched locking bar with the connecting rod, rubber bar, and plate with its spring hook rod, for disengaging said locking bar to relieve the rubbers from the peripheries of the wheels."

Claim.—"All that I claim as my invention, is the combination and arrangement of the suspended toothed or notched bar, staple, spring hook rod, connecting rod, and plate, for actuating and locking the rubbers against the peripheries of the wheels, and unlocking the same in passing over plains, by the action of the horses, as described and represented."

48. For a *Machine for Giving Increased Twist in Cutting Rifles;* Edwin Williams and James Culbertson, Kenton county, Kentucky, March 12.

The patentees say,—"The nature of our invention consists in so arranging a rifle guide, in a machine for rifling, or cutting the groove in rifles or other fire arms, that the machine can be made to cut a straight groove in the bore of the rifle, or be made to cut a regular twist, making a fraction of a revolution or a number of revolutions in the length of a barrel, or be made to cut a groove gradually increasing or decreasing in its twist as it approaches either end, being adjustable at pleasure to any required ratio of increase or decrease."

Claim.—"What we claim as new, is the jointing the guide, in combination with the chord piece for sustaining it in position, or their equivalents, for the purpose of giving the guide, as bent, when operated upon by the aforesaid lugs or screws, or their equivalents, a rocking motion, making the point of attachment to the traversing bar or other similar contrivance, describe a curve with reference to the bed which traverses beneath, thereby compelling the point of attachment to the traversing bar, or its equivalent, to recede in a gradually increasing ratio (accompanied by an equivalent increased velocity of the rotary head) from the axis of the mandril, for the purpose of producing an increasing or decreasing twist to the groove in the bore, after the manner substantially as herein described."

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49. For an *Improved Method of Applying Fusible Metal to Boilers;* Edward H. Ashcroft, Boston, Massachusetts, March 19.

The patentee says,—"My invention consists of a tube closed by a perforated cap filled with fusible metal; the cap is protruded through and secured in an opening made in that part of the fire or flue space of the boiler which soonest becomes unduly heated, so that its bottom is acted upon directly by the flame; and the open extremity of the tube is passed through the boiler and communicates with the external air; when the fusible metal melts it no longer opposes an obstacle to the passage of the steam through the perforations of the cap into the tube, but allows it to escape through the latter, and give notice of the heated state of the boiler."

Claim.—"What I claim as new, is inserting the fusible metal in a perforated cap which is protruded through and screwed into any sheet of the fire or flue surface of the boiler, substantially as herein set forth, in such manner that the bottom of the cap is exposed directly to the action of the heat, the fusible metal within the cap closing the end of the tube through which the steam rushes to give warning when the metal melts."

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50. For *Improvements in Looms for Wiring Piled Fabrics;* Mertoun C. Bryant, Lowell, Massachusetts, March 19.

The patentee says,—"The first part of my invention consists in cutting the loops on the wires, as the cloth is woven, by means of a reciprocating knife combined with the weaving part of the loom, and operated by a mangle motion, or any equivalent mechanical movement which will carry it across the face of the cloth and back.

"The second part of my invention consists in combining with the reciprocating knife for cutting the loops, a take-up roller provided with cogs which enter between the wires over which the loops are formed, to present by a position intermittent motion the range of loops successively to the knives, and parallel to their motion.

"The third part of my invention consists in combining with the knife for cutting the loops, beveled or wedge-formed guides, placed near the selvege of the cloth, between which the knife passes, and by which its edge is guided to enter the grooves in the figuring wires.

"The fourth part of my invention consists in combining with the knife for cutting the loops, a trough into which the wires drop, and a second trough into which they are successively transferred, that they may be carried back to and under the looping warps.

"The fifth part of my invention, which relates to an improvement in the method of transferring the wires to the open shed of the warps invented, and secured by letters patent to E. B. Bigelow, consists in combining with the trough into which the wires are transferred chains with projecting wings or spurs which, in succession, take the wires and carry them up and deliver them in an appropriate box at the side of the lay.

"And the last part of my invention which relates to an improvement on the method of guiding and supporting the looping wires secured by letters patent to E. B. Bigelow, consists in making the dents of the reed with slots or grooves in their front edge, through which and by which the wires pass, and are guided and supported as they are introduced in the open shed of the figuring warps."

Claim.—"What I claim as my invention, is, 1st, cutting the loops in the grooved wires as the cloth is woven, by means of a reciprocating knife, combined with the weaving parts of the power loom, and operated substantially as herein described.

"2d, Combining with the reciprocating knife for cutting the loops, a take-up roller, provided with cogs, which enter between the looping wires, substantially, as herein described, for the purpose of presenting the ranges of loops in succession, and in a proper position to the action of the knife, as herein described.

"3d, Combining with the reciprocating knife for cutting the loops, beveled or wedge-formed guides, placed near the selvege of the cloth substantially, as herein described, for guiding the knife at the commencement of the cuts, as described.

"4th, Combining with the reciprocating knife for cutting the loops, a trough into which the wires fall from the cut pile, and a second trough into which they are successively transferred, substantially as herein described.

"5th, Combining with the second trough into which the wires are transferred, chains with projecting wings, or spurs, substantially as herein described, for taking the wires in succession from the said trough, and transferring them to a wire box attached to the lay substantially as herein described.

"And lastly, Guiding and supporting the looping wires as they are introduced under the warps, by means of slots or notches in the dents, substantially as herein described."

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51. For an *Improvement in Machines for Planing Ornamental Mouldings;* John B. H. Chatain, City of New York, March 19.

Claim.—"What I claim, is the method of using two scrapers, one in advance of the other, in combination with a single gauge.

"I also claim the method of using the universal joint, in combination with the swivel carriage, and two gauges, the same being constructed, arranged, and operated essentially, as above set forth and described."

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52. For an *Improvement in Machines for Making Hat Bodies;* Woodbridge Eaglesfield, assignee of Edward F. Condit and Alfred Taylor, Springfield, Essex county, New York, March 19.

The patentees say,—"This improvement consists in combining with the feed rollers and brush, a cylindrical rotary card, and one or more narrow flat stationary cards, placed above, and so near to the cylindrical card as to be just in contact with it. This cylindrical card is between the feed rollers and brush, and parallel to them; its axis is in the same plane with the line at which the feed rollers meet or a little above it. A second cylindrical card is placed between the brush and the flat cards, and above the first cylindrical card, in such a position in relation to them, as to work against the face of the first cylindrical card, and to be operated upon by the brush.

"The fur as it is fed through the roller is received by the first cylindrical card, which revolves very rapidly, and the fur is thereby worked against the stationary card and its fibres separated.

"The second cylindrical card which revolves slowly, assists in the working and more thorough and complete separation of the fibres of the fur.

"The fur is then taken from the cylindrical cards by the brush, which also revolves with great rapidity, and is thrown into the trunk and carried forward and deposited upon the cone of the former."

Claim.—"What we claim as our improvement, is the combination of the rotating brush for throwing the fibres, with the cards, which take the fibres from the feed rollers, and separate and prepare them, and with the trunk which guides and the exhausted former on which the fibres are deposited substantially as herein described.

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53. For an *Improvement in Weighing Frames;* Charles Downer, Philadelphia, Pennsylvania, March 19.

Claim.—"What I claim as my invention, is the manner of constructing the portable frame for the scale beam as set forth; said frame consisting essentially of the hinged beam, movable standard, and platform, these parts being arranged and combined substantially as set forth."

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54. For an *Improved Apparatus for Trimming Vessels;* Evan L. Evans, Mount Holly, Burlington county, New Jersey, March 19.

The patentee says,—"My invention consists in a shifting weighted car running upon a railroad supported on a cradle, which is extended from one side of a vessel to the other, and is arranged in such a manner that either of its extremities can be raised to give a sufficient inclination to the rail track, to cause the car to run by its own weight to that side of the vessel which requires to be weighted to bring her to an even bearing."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the herein described method of trimming vessels by means of a shifting weight operated by an adjustable cradle substantially as herein set forth."

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55. For an *Improvement in Tools for Preparing Hubs for Boxes;* Andrew and Josias Fahrney, assignees of Samuel Fahrney, Boonsboro', Washington county, Maryland, March 19.

The patentee says,—"The nature of my invention consists in the construction of an implement, or tool, to be applied to the end of hubs of carriage and other wheels, for excavating and cutting out the same, by hand; for the reception of the ordinary wheel boxes, and also the circular recess in which the linch pin revolves."

Claim.—"What I claim as my invention, is the construction of the implement or tool described, for excavating or cutting out the ends of hubs of carriage and other wheels by hand, for the reception of the ordinary wheel boxes and linch pins,—the cutter being made to recede from the centre of the hub simultaneously, with the operation of cutting the excavation in concentric circles by the combined and simultaneous action of the screw and nut in connexion with the recessed bar and handles, transverse bar, and bow, arranged and operating in the manner and for the purpose set forth.

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56. For an *Improvement in Abdominal Supporters;* Samuel S. Fitch, City of New York, March 19.

The patentee says,—"The nature of my invention consists in a pad to support the abdomen, said pad being supported by means of two elastic steel bands which pass over the hips to the columns of the back where they each are fastened to, and rest upon the middle of an S plate of elastic steel, each end of the S plate having upon it a pad, which rests upon the back, and thus by this combination is the abdomen supported and the back uninjured."

Claim.—"What I claim as my invention, is two short elastic arms S shaped, connected with other parts of a supporter, with a pad upon each end—one pad to rest upon the short ribs behind the curve, and free from the spine, while the other rests upon the flat plate of the os ilium; each S plate being united at the middle to a long elastic arm by a mortise, allowing no motion but that of sliding in and out; the long arm and short arm always crossing at right angles through the mortise.

"2d, I claim the invention of two long elastic arms, in connexion with other parts of a supporter, and with the S shaped arms by a mortise and screw bolts—these arms so cut as when laid on a flat surface that the edge will be convex, then concave, and then straight; and formed so as to set flat upon the person, rising above the hips with a point of rest about one-third of its length from the back, and falling down in front to a pad, and by so adjusting the shape of the arms and point of rest, as to press directly upon the hernial rings and lift up the abdominal contents towards the top of the hips.

"3d, A supporter pad is to be thicker on the inside near its lower and outer edge at the point of termination, or lower fastening to it, of the long elastic arms, so as to press directly on the hernial rings; the lower outer edges being cut so as to follow the course of the groin, and the lower edge yoked, or cut convex, to go above the os pubis, thus acting upon all those parts occupied by the abdominal rings."

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57. For an *Improvement in Seed Planters;* John P. Groshon, Yonkers, West Chester county, New York, March 19.

The patentee says,—"The nature of my invention consists in the construction of a machine being provided with a hopper, into which the corn or other grain to be planted is deposited. The bottom of a hopper is provided with a slide, having holes perforated therein, through which the grain will fall, as these holes are moved over corresponding holes in the bottom of the hopper; this slide is worked by studs acting upon jointed levers, said studs being attached to the wheel on which the machine is supported, and which is made to revolve by the drawing power.

"The machine is provided with a share for making the furrow, and with rakes for closing it after the seed has been deposited, also with a slide, whereby the person operating can shut off the grain while the machine is still propelled, and the first mentioned slide consequently operating."

Claim.—"I claim the levers constructed with their ends in the manner substantially as described, to prevent the slides from being actuated when the motion of the wheel is reversed."

58. For an *Improvement in Hoisting Machines;* Sandy Harris, Philadelphia, Pennsylvania, March 19.

The patentee says,—The nature of my invention consists in this connexion, in applying to hoisting machines the twist break, as a means of checking or controlling the velocity when in action."

Claim.—"What I claim as my invention, is the twist break, whether constructed as set forth, or in any other way substantially the same; and whatever the nature or purpose of the machine to which it may be attached."

59. For an *Improved Process of Rolling India Rubber Cloth;* Francis D. Hayward and John C. Bickford, Colchester, New London county, Connecticut, March 19.

The patentees say,—"Our invention or process consists in taking a piece of cloth or any other sheet material (to whose surface it may be desirable to apply and fix India rubber) and a quantity of ground India rubber (when in a tacky or adhesive state, in which it is after being ground or reduced by the usual process of grinding crude caoutchouc), and running or passing the same together (the caoutchouc being on one side of the cloth) between two cylinders or rollers (placed with their axis parallel, and their curved surfaces in contact or nearly so), and in such manner, that while the upper of the said rollers, or that in contact with the caoutchouc is made to revolve at a greater speed or velocity than the lower one, it (the said upper roller, or that in contact with the caoutchouc) shall spread, and grind it as it were into the cloth, and below, and fix it to that surface of it which is immediately contiguous to said roller, viz: that roller which revolves at the greatest speed."

Claim.—"What we claim is the new and improved process of applying and fixing rubber to cloth by means of rollers; the said improved process being a combination of the method of spreading the rubber by the pressure of rollers, and the method of grinding and fixing it at the same time against and into the substance of the cloth, all as specified."

60. For an *Improved Method of Employing the Exhaust Steam;* George H. Hoagland, Piermont, Rockland county, New York, March 19.

Claim.—"What I claim as my invention, is the running the exhaust-pipe into the main steam-pipe, curving it, and providing it with an aperture and valve, substantially as herein described, by which the current of steam from the boiler has a tendency to open the valve at intervals and draw into the steam-pipe a portion of the exhaust steam."

61. For an *Improvement in Cooking Stoves;* Hosea H. Huntley, Cincinnati, Ohio, March 19.

The patentee says,—"The nature of my improvement consists in making what is usually an open bottom flue partake of the character of a hot air chamber in its front portion, by means of a partition, which passes entirely athwart the stove at about two-thirds the distance between the front and back oven plates. The remainder of what is usually the open bottom flue is made to partake of the character of reverting flues by compelling the heat and flame to pass down diving flues at the back corners of the stove, the partitions between these flues and the discharge flue leading to the pipe being carried down to the bottom of the stove, thereby forcing the draft to impinge, and prolong its impingement upon the back and bottom of the oven, as the draft winds down, along, and around the said partitions in its tendeny to escape up the pipe."

Claim.—"What I claim as new, is making the front part of what is usually an open flue under the oven to consist of a hot air chamber as described; and the rear part of the same, and also the space at the back of the oven to consist of reverting flues, by compelling the draft to pass over the top of the oven down back corner diving flues reaching from top to bottom of the stove, and then lick under the oven and around the division plate between these diving flues and the discharge flue; thus prolonging the contact of the heat with the back vertical and horizontal portions of the oven, and equalizing the distribution of the heat and flame so as to make the oven cook well from all directions."

62. For *Improved Beaters in Hide-handling Cylinders;* James R. Innis, Easton, Northampton county, Pennsylvania, March 19.

Claim.—"What I claim as new, is, 1st, the wheel having buckets diagonally across the surface alternately from right to left and left to right.

"2d, The rollers or slats in combination with the chamber, substantially in the manner and for the purpose set forth."

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63. For an *Improvement in Double Oven Cooking Stoves;* James McGregor, Jr., Wilton, Saratoga county, New York, March 19.

The patentee says,—"The nature of my improvements consists in protecting the division plate between the front boilers, by forming an oblong opening therein and permitting a current of cold air to pass through it; and in dividing the oven of the stove, when desired, into two parts, by introducing a movable horizontal flue, through which, when in place, a portion of the smoke and heat passes, there being openings in the front and back plates of the oven for that purpose.

Claim.—"1st, What I claim as my invention, is the movable flue for dividing the oven into two parts, as above specified.

2d, "I also claim forming an aperture in the division plate between the front boilers, to protect it from the intense heat of the fire, and to supply air for combustion as described."

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64. For an *Improved Centripetal Propeller;* John William Nystrom, Philadelphia, Pennsylvania, (late of Stockholm, Sweden,) March 19.

The patentee says,—"Whereas, in screw propellers, the water between the blades is acted upon at the same moment by two forces, the one being the propulsive force resulting from the oblique action of the revolving blades, and the other by the centrifugal force generated by their rotation; the first force tending to force the water backwards in directions parallel with the axis of the propeller, and the second force tending to force it outwards in directions at right angles to the axis. Now, my invention consists in counteracting the centrifugal force by the particular curve imparted to the blades of the propeller, in such manner that the water instead of being deflected outwards, is delivered in directions parallel with the axis of the propeller."

Claim.—"What I claim as my invention, is the peculiar curve given to the propeller blades, as herein set forth, to counteract the tendency of the centrifugal force to deflect the issuing water obliquely to the axis of the propeller."

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65. For an *Improved Method of Forming Sheet Metal Tubes;* William Ostrander and William Webster, City of New York, March 19.

The patentees say,—"The nature of our improvement consists in constructing a mandrel, or pattern former, and inserting said mandrel or pattern former between, and operating with the three (or more) friction, carrying, and supporting rollers."

Claim.—"What we claim as our invention, is the method of forming sheet metal tubes, *&c.*, upon a mandrel, supported by and obtaining its revolutions from three or more rollers, one or more of which are adjustable, substantially in the manner described."

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66. For the *Use of the Oxide of Tin in the Manufacture of India Rubber;* Horace H. Day, Jersey City, New Jersey, assignee of John Pridham, New Brunswick, Middlesex county, New Jersey, March 19.

The patentee says,—"My invention consists in combining tin in a state of powder with rubber, and vulcanizing the same by the use of sulphur exposed to a high heat, according to the well known process of vulcanized rubber."

Claim.—"What I claim as my invention, is the combining rubber with tin as set forth, and the combination of these with sulphur and heat, whereby I produce a fabric having a black surface, and which is capable of withstanding all the elements which distinguish vulcanized from other preparations of rubber."

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67. For an *Improvement in Steering Apparatus;* Phineas P. Quimby, Belfast, Waldo county, Maine, March 19.

Claim.—"What I claim as my invention, is attaching the nut acted upon by the screw to an interposing lever, arranged substantially as herein described, by which arrangement I am enabled, with the same pitch of screw and the same number of revolutions of the wheel, to move the rudder through a larger arc than in the old apparatus."

68. For an *Improvement in Pumps for Ships;* Franklin Ransom, City of New York, March 19.

The patentee says,—"The first part of my invention consists in making the pump barrel and supply pipe, or pipes, separate, and combining them by means of an exhaust chamber, into which the water shall be forced by atmospheric pressure, and from which it shall flow by its gravity into the pump barrel, whereby the water moves in the supply pipe by a continuous motion, without any check from and without presenting any resistance to the downward motion of the piston.

"The second part of my invention consists in making a small lateral hole in the barrel of the pump, and at about the middle of the range of motion of the piston, and communicating with the exhaust chamber, so that after the chamber has been exhausted by the working of the piston, and the water begins to flow into the pump barrel, the action of the piston shall still continue to exhaust the chamber above the water therein through the said hole; the water in the pump barrel and above the piston acting as a valve to prevent atmospheric air from entering the exhaust chamber.

"The third part of my invention consists in combining with the exhaust chamber, which combines the pump barrel and supply pipe, a strainer sieve, or filter, interposed between the pump barrel and supply pipe, so that the water discharged in the exhaust chamber, by the supply pipe, shall flow through the said strainer, sieve, or filter, before it enters the pump barrel, thereby effectually protecting the valves and piston against the evil effects of solid foreign matter.

"And the last part of my invention consists in inserting the supply pipe from above, and securing it to the bottom of the exhaust chamber, when this is combined with a large valve on the top of the exhaust chamber, which covers an aperture made therein of a sufficient capacity to give access to the inside for inserting the supply pipe, and for repairing and cleaning."

Claim.—"What I claim as my invention, is combining the pump barrel of suction pumps, in which are placed the check or stop valve, and the piston, with the supply pipe or pipes, by means of an exhaust chamber into which the water flows by atmospheric pressure, and from which it runs by gravity into the pump barrel, substantially as and for the purpose specified.

"I also claim in the combination next above specified, making a lateral hole through the pump barrel, and communicating with the exhaust chamber, substantially in the manner and for the purpose specified.

"I also claim combining with the exhaust chamber, which unites the pump barrel and the supply pipes, and interposing between these a strainer, sieve, or filter, substantially as described and for the purpose specified."

69. For an *Improvement in Churn Dashers;* Nathaniel Routzahn, Middletown, Frederick county, Maryland, March 19.

Claim.—"What I claim as my invention, is the combination of the whirls with the revolving frame dasher, the several members being arranged and constructed, substantially in the manner set forth."

70. For an *Improved Movement of the Pointing Dies in Spike Machines;* Edmund Sawyer, Boston, Massachusetts, March 19.

Claim.—"What I claim as my invention, is operating the curved dies for pointing a spike, by setting them in the adjacent ends of two sets of toggles arranged with the cam projections and guiding blocks, and the whole operated substantially as described."

71. For an *Improvement in Machines for Sawing Marble;* E. W., H. F., and A. H. Tingley, assignees of Albert H. Tingley, Providence, Rhode Island, March 19.

Claim.—"What I claim as my invention, is the combination of mechanism applied to the sprocket wheels, endless chain, windlasses, and suspension chains of the saw frame, the said combination being for the purpose of gradually lowering the gang of saws in the proportion required, as the sawing process progresses. This combination consists of the train of mechanism which is applied to the lower sprocket wheel shaft, or axle, and the driving shaft, and intervenes between the two, and is actuated by the revolutions of the driving shaft; said train of mechanism consisting of the tooth gear, pinion, gear wheel, endless screw, beveled wheel, pinion and ratchet wheel, together with the pawl, arm, connecting rod, slotted plate, rocker shaft, crank, screw, screw nut, washers, cranks, and connecting rod as above specified. Not meaning to claim as any part of the same the crank l', click k', and ratchet wheel i', except in their combination therewith, and for the purpose of enabling a person to raise or lower the gang of saws by applying his hand to the crank; it being understood that when these last contrivances are not used, the gear wheel must be firmly fixed to its axis, and not placed loosely thereon as it is when such contrivances are employed.

"I also claim the employment of the two arms extending in opposite directions above and below their rocker shaft, and used in the manner and for the purpose as specified.

"I also claim the vibratory tubular watering apparatus and mechanism combined with it, said mechanism consisting of connecting rod, pulley g', endless band, and pulley s', for giving to it a reciprocating movement over the gang of saws and stone as specified."

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72. For an *Improvement in Cast Iron Car Wheels;* Asa Whitney, Philadelphia, Pennsylvania, March 19.

The patentee says,—"The design of my improvement is to give railroad wheels more strength with the same, or a less amount of material than has heretofore been employed for that purpose. This I do by making the form of the main part of the disk, or that part of the wheel between the rim and hub corrugated in radii from the centre, with projecting ribs alternately on each side extending from the hub to the rim."

Claim.—"What I claim as my invention, is the projecting ribs in combination with the corrugated disk in the manner and for the purposes herein set forth."

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73. For an *Improved Blind Slat Operator;* David R. Williams, Prospect, New Haven county, Connecticut, March 19.

The patentee says,—"The nature of my invention consists in the application of bevel wheels, and a movable joint to the blinds of windows, so that the slats may be opened or closed from the inside of a room without raising the window."

Claim.—"What I claim is the combination of the bevel wheels and the movable joint, essentially in the manner and for the purposes herein described."

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74. For an *Improvement in Artificial Legs;* George W. Yerger, Philadelphia, Pennsylvania, March 19.

Claim.—"What I claim as my invention, is the exclusive privilege of making artificial skeleton legs of thin metallic ribs or plates, and rings or hoops united together by rivets, or other suitable fastenings, substantially in the manner set forth irrespective of any particular combination with other parts connected therewith."

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75. For an *Improvement in Apparatus for Receiving and Transferring to the Pile Sheets of Paper from Printing Presses and Paper Machines;* Isaac Adams, Boston, Massachusetts, March 19.

The patentee says,—"My invention consists in so combining a cylinder, or a curved instrument, suitably constructed for the purpose, instead of the 'fly' described in the patent granted to me March 2d, 1836, with machines for the printing and manufacturing of sheets of paper, that said cylinder or curved instrument shall receive such sheets, and pile them upon a table provided for the purpose; and also in so combining certain mechanical powers and movements with such table, that the accumulation of sheets upon said table by bringing into contact certain parts, produces a movement, which causes said table to descend in such manner as to keep the top of the pile upon it at nearly the same height constantly; the increase of the depth of said pile being used as a means by which to cause the apparatus for the purpose to perform its office.

"I claim the above described device, viz: the cylinder, in combination with the rollers and the bands, or any device substantially the same (the above named 'fly' not being included) for receiving the printed sheets from printing machines, or printing presses, upon a curved or cylindrical surface, and by means of said curved or cylindrical surface, transferring them with their printed sides upwards to the pile, or the table prepared to receive them.

"I also claim the device embodied in the combination, consisting of the screws, the pawl, the lever, the part h', the click, the wheels, and the tables, or any device substantially the same for lowering the pile of sheets, the accumulation of said sheets governing the operation as aforesaid.

76. For an *Improvement in Brick Presses;* Collins B. Baker, Troy, New York, March 19.

Claim.—"What I claim as new, is, 1st, the employment of the mounted roller turning independent of the wheels on which it is borne, and forming a guiding carriage for the moulds, substantially in the manner and for the purpose set forth.

"I also claim the stop, or weighted catch lever, for guiding the moulds in entering under the grating."

77. For *Improvements in Balloons and their Appendages;* Hugh Bell, London, England, March 26; anté dated November 23, 1848.

Claim.—"What I claim as my invention, is the application of one or more flexible partitions, which I have termed the 'septum membrane' to balloons, for the purpose described.

"2d, I claim the application of a rotary motion in conjunction with a hinge motion, for the purpose of producing motion in the fan, or blade, forming the tail, which motion is more or less assimilated to that of a bird's tail, in order to effect the steerage substantially in the manner described.

"3d, I claim the use of the water grapnel, for the purpose of arresting the motion of aerial machines, and also the application of elastic ropes to grapnels, either for land or water, and which elastic ropes may be formed entirely of elastic material, or by introducing some elastic material or metal spring in its length.

"And lastly, I claim the construction of the valve as applied to balloons, in which the valve, or plate, during its motion retains a position parallel to its seat."

78. For an *Improvement in Filters;* W. Latting, assignee of Charles D. Birdseye, City of New York, March 26.

Claim.—"What I claim as new, is the construction and arrangement of the filter with a woolen woven fabric wound on to a spool, substantially as set forth, and admitting the water so as to pass down through the cloth presented edgeways, as fully described."

79. For a *Method of Connecting the Sections of Gold Washers;* Russel Burton, Rome, Oneida county, New York, March 26.

Claim.—"What I claim as my invention, is the mode of connecting and holding firmly together said sections by means of the strips of iron, the rods, the socket, and the chain, substantially in the manner and for the purposes set forth."

80. For an *Improvement in Exercising Chairs;* Solomon Chapin, Ashland, Ashland county Ohio, March 26.

The patentee says,—"My invention therefore consists in constructing a chair, with an apron to support the legs of the sitter hinged to the front of the seat, and a back hinged to the hinder part of the seat, the back and apron being connected by adjustable arms in such manner that the pressure of the back of the sitter against the back of the chair is counterbalanced by the weight of his legs upon the apron, the two being in equilibrium, thus enabling the sitter to place himself in any position, or to rock to and fro, with but slight exertion, while the variation in the length of his limbs, caused by the flexure of the joints, is compensated by a spring foot board. The apron and back may also be fixed in any desired position by a clamp of peculiar construction."

Claim.—"What I claim as new, is connecting the movable apron and back by means of adjustable arms, substantially as herein set forth, whereby the back and legs of the sitter can be so equally balanced that he can rock himself to and fro with the slightest exertion.

"I also claim the adjustable self-adjusting foot board, in combination with the movable apron, substantially in the manner and for the purpose set forth."

81. For an *Improvement in Blast Pipes for Conveying Heated Air and Gases to Furnaces;* Ransom Cook, Saratoga Springs, Saratoga county, New York, March 26.

The patentee says,—"The nature of my invention consists in a mode of partially arresting and returning to the fire the escaping products of combustion, so that the combustible gases and particles of carbon may be there consumed, with the double benefit of effecting a saving in fuel and abating the nuisance created by the smoke."

Claim.—"What I claim as my invention, applicable to heating and smelting operations, is the application of this method of creating such draft or partial vacuum to the return of the smoke and other escaping products of combustion to the fire, in order that such of them as are combustible may be there consumed; the method or means consisting substantially in the manner of employing the blast pipe, inclosing the hot air pipe, as herein set forth."

82. For an *Improvement in Bee Moth Traps;* George Fletcher, Sr., Greensburg, Decatur county, Indiana, March 26.

The patentee says,—"The nature of my invention consists in making the bottom or floor of the hive of two opposite oblique surfaces, approximating to two sides of a prism, with a fluted roller revolving in the partial interval between their converging edges, which roller is rotated by the air operating a vane or wind wheel on the outside. This keeps it almost constantly in operation, and as the bee bread, refuse of the hive, droppings, and other matters, fall to the bottom, they are carried out by the grooves as they come round, and fall to the ground, the roller thus serving as a cleaner to the hive, preventing the accumulation of dirt and refuse of the operations of the bees, which is injurious as affording harbor for the miller, and likewise a temptation to her to enter the hive."

Claim.—"What I claim as new, is the combination of the fluted roller, operated as described, with the moth entrance of the bee hive, to act as a moth-catcher and killer, substantially in the manner and for the purpose described."

83. For an *Improvement in Seed Planters;* George Fletcher, Sr., and Turner Barnes, Greensburg, Decatur county, Indiana, March 26.

The patentees say,—"The first part of our invention consists in the introduction of a cleaning rod into the hollow share which cuts the furrow, and through which the seed falls, so as to prevent the clogging and accumulation of earth in the orifice, which is fatal to the operation of the seeder.

"The second part of our invention consists in placing a smaller share midways of the intervals of the former ones, so as to follow in the space between them, thereby dividing the ridge of earth cast up by them, and throwing it to either side so as more perfectly to cover the seed.

"The third part of my invention consists in the method by which the whole cleaning and seeding apparatus is thrown out of gear with the driving wheels which support the carriage, by hinging the frame which supports and contains the whole series of shares, secondary shares, cleaners, seed trough, and feeding screw, to the framework resting immediately upon the axles, and raising or lowering it in or out of gear with the cog wheel on the driving wheel axle by means of a rack and pinion, with a click falling into the intervals of the teeth of the same for retaining it in position."

Claim.—"What we claim as new, is, 1st, the introduction of a cleaning rod, operated as described, into the hollow share of a seed planter, for the purpose of removing extraneous matters that may have entered the orifice, tending to impair or prevent the action of the machine."

84. For a *Combined Hard and Soft Metal Packing;* Andrew Fulton, Pittsburg, Pennsylvania, March 26.

The patentee says,—"My metallic piston packing consists of a ring of soft metal, embraced between two rings of a harder metal, which expand with the soft metal as the latter is forced outwards by the tightening of the piston follower."

Claim.—"What I claim as my invention, is the compound metallic packing ring constructed of hard and soft metals, substantially as herein set forth, the hard rings being for the purpose of preventing the substance of the softer from squeezing out around the follower and flanch of the piston."

85. For an *Improvement in Printing Presses;* Geo. P. Gordon, City of New York, March 26.

The patentee says,—"My improvements consist of an inking apparatus, and of an arrangement for laying, griping, and retaining the sheet or card to be printed, carrying it over the form, and when printed discharging it into a box or drawer placed to receive it."

Claim.—"What I claim as new, is, 1st, the peculiar manner of constructing the nippers, so that their upper surface shall be even with the upper surface of the paper, and their inclined or curved surface shall incline away from the surface of said paper.

"I also claim an adjustable table to be adjusted to the nippers, the nippers being first adjusted to the pipe or form, substantially as set forth.

"I further claim a frisket operated on by the motion of the carriage, so that when the carriage goes in with the sheet, its forward end shall raise under and support the paper, and, from the upward pressure of the nipper against the platen in giving the impression, grip it firmly, and relieve it from the type after the impression is given; and on the receding of the carriage with the printed sheet, its forward end shall lower and allow the said sheet which rests upon it, to slide or fall off into a box or drawer placed to receive it, operating substantially as above described.

"I further claim the application of the vibratory power to the handle of a distributing roller, (said handle projecting from the frame of said roller midway from its respective ends,) and not to the end of the roller frame as in general use.

"I further claim the combination and arrangement for opening the nippers when the carriage moves out with the printed sheet, and closing them just previous to its going in, which combination consists of the horizontal bars or polls, the curved pieces, the lever attached to the shaft, the hub with its projection on the main shaft, and the spiral spring, one end of which is attached to the press frame; the whole being arranged and operating together substantially in the manner herein above set forth and described."

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86. For an *Improvement in Correcting Magnetic Needles;* Calvin Guiteau, Syracuse, Onondaga county, New York, March 26.

Claim.—"What I claim as my invention, is the method herein described of producing perfect harmony and coincidence between the axis of a magnetic needle and the magnetic axis, and also of producing perfect harmony between any number of magnetic needles, to wit, removing portions from the needle, whether by the formation of channels upon the upper or lower surface of the needles, of the form and in the position substantially as herein set forth, or merely by grinding or filing, or cutting away, as above set forth."

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87. For an *Improvement in Fountain Pens;* Ellsworth H. Hyde and Rollin L. Dawson, Haydenville, Hampshire county, Massachusetts, March 26.

The patentees say,—"Our improvement consists in so constructing and attaching the tongue that it will form a fountain while writing and yet may be readily removed so as to allow the pen to be cleaned, essentially with the same facility as the ordinary pen, while the pen is suited to the ordinary holder."

Claim.—"What we claim as our invention, is the combination of the movable spring tongue with the pen, for the purpose of forming a fountain pen, when the whole is constructed, arranged, and combined substantially as herein described."

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88. For *Improvements in Revolving Breech Fire Arms;* Hans Iverson, City of New York, March 26.

Claim.—"I claim as new, 1st, the arrangement of the arm and slides, or their equivalents, whereby the motion of half-cocking and cocking the hammer is communicated to the barrel to open the joint formed by the grooves around the breech, and also to close said joint on the discharge of the piece by the operation of the hammer, slides, and spring alone, or in conjunction with the main spring, substantially as described.

"2d, I claim the arrangement of the slide and circular ratchet, or their equivalents, whereby the motion of the barrel sliding forward is made to revolve the chambers the required amount, to bring the next chamber in line for the next discharge of the piece, substantially as shown."

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89. For a *Machine for Forming Rotary Cutters;* Andrew Jennings, Fall River, Bristol county, Massachusetts, March 26.

The patentee says,—"My invention consists mainly in an improved method of making the cutter or tool for a gear cutting engine, and I use a head having two steel cutters so placed and operated as to be susceptible of a great degree of nice adjustment, and consequently am capable of producing a more perfectly formed tool for cutting gear than any method hitherto in use."

Claim.—"What I claim as of my own invention, is the arrangement upon puppet-heads having a sliding motion upon a bed plate, of adjustable slides, supporting disks to which are attached the boxes in which the cutter shafts revolve; the disk being capable, by means of vibratory motion on their axes, of adjusting the cutter shafts to any required angle with the horizon, and the whole machine being for the purpose of shaping at the same time both faces of a revolving cutter, substantially as herein described."

90. For an *Improvement in Cultivator Teeth;* Lewis Lamborn, Kennett-Square, Chester county, Pennsylvania, March 26.

The patentee says,—"My invention consists in so forming the wings or mould-boards, cutter, and share, that the cutter may be made of steel and changeable at pleasure, and with a single share that may be changed eight times before it is rendered unfit for use."

Claim.—"What I claim as my invention, is, 1st, the manner of constructing the cultivator tooth substantially as above described, by which a separate steel cutter is embraced between the two halves of the tooth, removable at pleasure, and by which wedges can be applied against the shoulders of the tooth and the under side of the beam, for the purpose of changing the angle of inclination of the share, in order to increase or diminish the depth of culture; the tooth turning on the bolt passing through the head of the same and the beam whilst inserting the wedges; the wings of the tooth being secured to the four-sided changeable share by means of screws and nuts, or other equivalent means."

91. For an *Improvement in Printing Floor Oil Cloth;* Leverett Moore, Ballston Spa, Saratoga county, New York, March 26.

Claim.—"What I claim as my invention, is, 1st, the combination of the stops with the block, by which the printing of the floor oil cloth is performed without moving the stops until the first printing is finished, and dispensing with a second block to cover the parts of the cloth not printed at the first operation, by simply changing the position of the hinged gauges on the block without moving the stops on the bar, as described, thus dispensing with the second block usually employed."

92. For an *Improvement in Threshing Harvesters;* Samuel S. Rembert, Memphis, Shelby county, Tennessee, March 26.

The patentee says,—"The nature of this invention consists in securing to the front part of a horizontal concave, arranged at the lower part and on one side of the machine, a stationary knife, and suspending immediately above the same, on suitable journals, a revolving wheel of diagonally arranged beaters, having teeth on their outer surfaces corresponding with teeth in the concave, in such a manner as to cause said revolving beaters to force the grain against said knife, as the machine is drawn towards the same by any suitable power, with sufficient force to cut the stalk of the same, and drive it between the teeth of the beaters and concave, so as to thresh it, and from thence convey it to a vibrating sieve or screen, through which it passes into a current of air produced by a fan, which cleans it of chaff and other extraneous matter lighter than itself, into a box, from whence it is taken by an endless belt of elevators and deposited in an upright box at the back part of the machine."

Claim.—"What I claim as my invention, is the mode of cutting and threshing the grain, by forcing the same against the knife, and, after being cut, between the teeth of the concave and the teeth of the gathering and threshing wheel, or shaft of bars or beaters, during the progress of the machine, as herein set forth."

93. For an *Improvement in Plough and Clevis;* Ira Reynolds, West Liberty, Logan county, Ohio, March 26.

Claim.—"What I claim, is, 1st, making the reversible point with the triangular shoulders, in combination with the screw and nut, for binding firmly together the land-side and mould-board, cutter and share, as well as securing itself, in the manner described.

"2d, I claim the device of fastening the reversible share to the flanch on the lower part of the mould-board, substantially as set forth.

"3d, I also claim the manner of employing the inclined brace rod, in combination with the box plate cast on the inside of the mould-board, for adjusting the beam to take more or less land, to act as a substitute for the clevis, and at the same time to brace or stiffen the wood-work of the plough, by attaching it to the cast iron mould-board and land-side, as described."

94. For an *Improvement in Dental and Surgical Chairs;* Flavius Searle, Springfield, Hampden county, Massachusetts, March 26.

Claim.—"What I claim as my invention, is the application to chairs of the middle section, substantially as described, whether operated by rack and gear, or by lever, or windlass, or screw, at two corners of the chair, or at four, or at any intermediate point, provided the same results are obtained by substantially the means set forth."

95. For an *Improvement in Cheese Presses;* Augustus N. Severance, Cherry Valley, Ashtabula county, Ohio, March 26.

The patentee says,—"The nature of my invention consists in combining with cheese presses two beds which revolve together on a horizontal axis, and thus furnish an easy and convenient method of turning the cheese in the press."

Claim.—"What I claim as my invention, is combining with cheese presses two beds upon which the cheese is alternately pressed, which revolve together on a horizontal axis, substantially in the manner and for the purposes set forth."

96. For an *Improved Method of Dressing Cut Tobacco;* Gideon Wales, Liberty, Sullivan county, New York, March 26.

The patentee says,—"The nature of my invention consists of a tube with teeth on the inside, having an inclination below an horizontal line, and through which, under a slowly revolving motion, the tobacco is made to pass."

Claim.—"What I claim as my invention, is the method of dressing cut tobacco by passing it through a revolving cylinder, having holes through it to sift the short from the long pieces, and with hooks or pegs projecting from its inner surface towards the centre for lifting the threads of tobacco, as described above."

97. For an *Improvement in the Seed Roller of a Seed Planter;* Edward Wicks, Bart township, Lancaster county, Pennsylvania, March 26.

Claim.—"What I claim as my invention, is the before described mode of constructing the planting cylinder, by which the cavities or cells in the periphery are enlarged or diminished simultaneously, by simply turning the plate or other similar device, having its sections of male screws on its inner face, and causing said sections to act on all of the radial slides forming the bottoms of the cavities at the same time, and holding them firmly in the required positions by the thumb screw, or other equivalent mechanical device, substantially as aforesaid, by which like results are produced."

RE-ISSUE FOR MARCH, 1850.

1. For a *Machine for Cutting the Threads of Wood Screws;* The New England Screw Company, assignee of Cullen Whipple, Providence, Rhode Island; patented August 18, 1842, re-issued March 5, 1850.

Claim.—"What is claimed as new, is, 1st, in combination with the shaft or mandril which gives the rotary motion to the screw blank, the employment of the rotating wedge-formed cam, or the equivalent thereof, for determining the pitch of the thread, and for permitting the return motion to repeat the operation, substantially as described.

"2d, Causing the chaser or cutter, at each successive cut, to approach nearer to the axis of the screw blank by means of a revolving conical cam, which, at each successive operation, acts by a greater radius, substantially as described.

"3d, Governing the motions of the chaser or cutter to make the core of the body of the screw of a conical or tapered form along the whole or any part of its length, by combining therewith a cam of gradually enlarged diameter, substantially as described, the form of such cam depending on the form intended to be given to the core or body of the screw.

"4th, Combining the cam which determines the form of the core or body of the screw, to make it tapering or conical, in whole or in part with the chaser or cutter, by means of a rock shaft and adjustable lever, substantially as herein described, the said adjusting lever being interposed between one of the arms of the rock shaft and the face of the cam, so that, by the use of a set screw or other analogous device, the cutter or chaser may be readily set, as described.

"5th, Shifting the cam which determines each successive cut of the chaser or cutter, by combining therewith a ratchet movement operated by an eccentric or cam, the wheel of the ratchet being provided with pins which operate a lever connected with the cam to shift, substantially as described.

"6th, Disconnecting the shaft or mandril from the driving power at the end of each complete operation of the machine, by combining the clutch or the equivalent thereof with the ratchet by means of an index wheel or perforated rim, which at the required periods liberates or acts upon the connexions of the clutch to disengage it, substantially as described.

"7th, Making the chaser or cutter, for chasing or cutting the threads of wood screws by machinery, with a groove of the form of the thread in its cutting face, and in the direction of its length, substantially as described, whereby the said chaser can be sharpened by simply grinding off at the end, and without changing the form of the groove, and whereby also the said chaser cuts on both sides of the thread, and finally on the edge thereof, as described."

Designs for March, 1850.

1. For a *Design for Stoves;* William P. Cresson, assignee of Wm. P. Cresson, David Stuart, and Peter Seibert, Philadelphia, Pennsylvania, March 12.

Claim.—The ornamental design for a stove called the cast iron parlor air tight, herein fully described, and represented in the accompanying drawings.

2. For a *Design for Stoves;* William P. Cresson, assignee of Cresson, Stuart & Seibert, Philadelphia, Pennsylvania, March 12.

Claim.—The ornamental design for a stove called air tight parlor, herein fully described, and represented in the accompanying drawings.

3. For a *Design for Stoves;* James H. Conklin, City of New York, March 12.

Claim.—The arrangement and combination of the several original ornamental figures, letters, and mouldings upon this particular stove, as described and represented by the drawings.

4. For a *Design for Chandeliers;* Ellis S. Archer and Redwood F. Warner, Philadelphia, Pennsylvania, March 19.

Claim.—The ornamental design for a chandelier, set forth in the drawing as our original design.

5. For a *Design for Stoves;* Samuel A. House, Mechanicsville, Saratoga county, New York, March 26.

Claim.—The design and configuration of the ornaments, so disposed on the doors, feet, and other parts of the stove, constituting, in combination, a new design of cook stove, the same as described and represented.

6. For a *Design for Stoves;* Richard Peterson, assignee of Peterson, Stuart & Seibert, Philadelphia, Pennsylvania, March 26; anté dated December 22, 1849.

Claim.—The ornamental design for a stove called a complete cook, fully described and represented in the drawings.

7. For a *Design for a Portable Furnace;* Charles W. Warnick, Frederick Liebrandt, James G. Abbott, and Archilas Lawrence, Philadelphia, Pennsylvania, March 26.

Claim.—The described ornament and illuminated design for portable furnaces.

List of American Patents which issued in April, 1850, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For a *Clamp to be used in the Manufacture of Wrought Iron Car Wheels;* Herrick Aiken, Franklin, Merrimac county, New Hampshire, April 2.

Claim.—"What I claim as my invention, is the construction and application of the combined cylindrical clamp, consisting of the following parts—namely, the ring AA^2 of an L shaped section with handles attached, and ring D, and screw bolts, applied for the purpose of confining and holding the wrought iron arms, or spokes, in a true circle together with the pieces in the centre, to form the hub, during the operation of welding the several parts together as decribed."

2. For an *Improvement in Machines for Hoisting;* William C. Allison, Philadelphia, Pennsylvania, April 2.

Claim.—"What I claim as my invention, is the separate and independent action, each upon its own axis of the two upper pulleys, whereby the buckets or weights are suffered to pass freely between them without let or hindrance.

"And in combination therewith, I claim also the swinging of the buckets or weights between the chains, so that they shall always hang downward in whatever position the parts of the chains to which they are attached may be."

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3. For an *Improvement in Cooking Ranges and Heating Air;* Elias T. Beers, Honesdale, Wayne county, Pennsylvania, April 2.

The patentee says,—"The nature of my invention consists in the arranging and combining a hot air chamber, with a range, and the flues thereof, in such a manner as to obtain a compact portable and economical cooking range and oven, and hot water and air heater, or stove."

Claim.—"What I claim is the employment and use of the combination of the furnace and oven in the hot air chamber, with the radiating pipes, flues, and dampers, for the purposes substantially as herein set forth."

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4. For an *Improvement in Chimney Caps;* Michael H. Collins, Boston, Massachusetts, April 2.

Claim.—"What I claim as new, is the injector in its combination with the cap plates, tube and frustrum, and made stationary against the cap plate, all substantially as specified.

"And in combination with the cap plate, the frustrum and the tube, I claim one or more flat plates, or rain fenders, as applied and used substantially in the manner as explained."

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5. For an *Improvement in Churns;* Robert W. Davis, Rodgersville, Steuben county, New York, April 2.

Claim.—"What I claim as new, is, 1st, the self-adjustable float or slat, which opens when churning the cream, and closes of itself when the dasher is turned in the opposite direction to gather the butter as described."

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6. For an *Improvement in Saw Mills;* Waitman Davis, near Granville, Monongalia county, Virginia, April 2.

The patentee says,—"My improvements relate to the particular manner of arranging and operating certain levers and bars, by the depression of a foot lever and the agency of two arms, one projecting from the rag wheel, and the other from the front end of the carriage by which the several levers and bars are actuated, so as to disengage the reaching arm and pawl from the rag wheels, and operate a turning bar to set the ends of the log simultaneously for another cut; and after which, at the same operation, elevate the foot lever, and engage the reaching arm with the rag wheel to feed the carriage to the saw.

"And to the manner of combining upright gauge setting bars attached to the head and tail blocks of the carriage, with a horizontal weighted turning bar having thereon two eccentrics, which are attached by loops or rods to the ends of two bars for holding the slides during the operation of sawing, and release the same when setting the log.

"Also the arrangement of a shaft parallel with the shaft of the rag wheel, having on its end a pinion for engaging with the rack of the carriage, simultaneously with the descent of the foot lever, for winding up a cord and weight attached thereto, for relieving the tightening lever from the band, and unwinding the same after the setting of the log, and giging back of the carriage to give motion to the crank shaft."

Claim.—"What I claim as my invention, is, 1st, the combination and arrangement of the levers with the catch bar, cam, and sliding bar, by which the depression of the foot lever is made to actuate the several levers above mentioned, and the cam made to lift the lever (*n*) and thus operate the turning bar, and with the gauge bars, and thus set the log; and at the same operation elevate the foot lever, and engage the reaching arm with the rag wheel to feed the carriage forward as described.

"2d, I also claim the combination of the upright gauge turning bars with the horizontal weighted turning bar, holding bars, and eccentrics thereon, by which the log is set simultaneously at both ends, and the slides prevented from moving during the operation of sawing by the holding bars, as described.

"3d, I also claim the arrangement of the shaft and pinion for engaging with the rack of the carriage, simultaneously with the descent of the foot lever for winding up a cord and weight, for relieving the tightening lever from the band, and unwinding the same with the ascent of the foot lever after the setting of the log, and giging back of the carriage to give motion to the crank shaft as described."

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7. For an *Improvement in Harness Hames;* Andrew Dietz, City of New York, April 2.

The patentee says,—"The nature of my invention consists 1st, in making the upper and lower parts of the back or drawing face of the hames, situate opposite the upper and lower parts of the shoulder blade, which are points of motion curved off forwards; and that part of the inner side between the points where the said curves commence, swelled so as to fit the shape of the horse, and so as to bring the pressure of the draught upon or in the sink of the neck, which is comparatively a part of rest, leaving the parts where there is much action free from pressure; and applying the force of draught at the part where there is least motion and the greatest amount of muscle overlaying the shoulder blade, and which is the part best capable of sustaining it, rendering the displacement or disarrangements of the collar almost impossible, and avoiding much chafing, and in most cases all.

"2d, In an improved mode of securing the draught iron to the hame; and,

"3d, In passing the straps which hold together the upper ends of the pair of hames, under and between hook studs, instead of through slots cut in the wood work of the hames, so as to allow the straps to be removed without unbuckling them."

Claim.—"I claim, 1st, curving or inclining forward, the upper and lower parts of the back or drawing surface and the inner projecting edge of the hame, substantially in the manner and for the purpose herein described.

"2d, The stock of the draught iron for securing the same to the hame, by means of the shank of the breast ring passing through the said stock of the draught iron and rivetted to the hame as described.

"3d, The hook studs for receiving the straps which secure the upper ends of the hames together when on the horse, so as to allow the straps to be easily shifted, constructed in the manner described, or in any other way substantially the same."

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8. For an *Improved Atmospheric Churn;* Simeon F. Emerson, Canaan, Wayne county, Ohio, April 2.

The patentee says,—"My improvement consists in constructing the dasher in a peculiar manner which unites simplicity and efficiency, and in securing inclined tubes to the sides of the churn tub, which tubes not only assist the mechanical action of the dasher, but in addition feed down air into the milk or cream during its agitation."

Claim.—"What I claim as my invention, is the combination of the dasher with the stationary inclined air chambers on the churn tub, the two being made, arranged, and operating substantially as set forth."

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9. For an *Improvement in Temples, used in Weaving Double Cloth;* Stephen Everett, Biddeford, York county, Maine, April 2.

Claim.—"What I claim as my invention, is the combination of the jointed rods with the wheels or pulleys at the ends of the rods.

"I also claim the wires fastened at one end to the bars or rods, and having the other end bent at such an angle as to enter a slot in or upon the breast beam, for the purpose of retaining the temple in a proper position.

"I also claim the slot in or upon the breast beam, when the same is used in connexion with the temple as described"

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10. For an *Improved Pocket Filtering and Drinking Tube;* Abijah Fessenden, Boston, Massachusetts, April 2.

The patentee says,—"My invention consists in attaching to a tube suitable and convenient to draw water through with the mouth, a strainer of wire cloth and felt or other suitable filtering medium.

Claim.—"What I claim as my invention, is the fitting a filter to a tube of greater or less length, substantially in the manner set forth, so that water may be strained by the very act of drinking."

11. For an *Improvement in Parlor Air Heating Stoves;* Lemuel W. Gosnell, Baltimore, Maryland, April 2.

Claim.—"What I claim as my invention, is the combination of the cold air chamber and valve, with the hot air annular chamber, and the reservoir or chamber below the horizontal plate in the chimney flue and behind the recessed fireboard, as described, the cold air chamber being provided with an opening to let the cold air into the annular hot air chamber, and small openings to let a portion of the cold air into the reservoir and the valve.

"I likewise claim the combination of the hinged water holders with the recessed fireboard, said holders serving the double purpose of evaporator, stands and valves, as described, for moistening the air and admitting warm air from the reservoir or space behind the fireboard, or directly into the parlor.

"I also claim the arrangement of the valves in the segmental top of the fire board, as described, for letting the warm air from the recess of the fire board into the reservoir, to be conveyed thence wherever desired."

12. For an *Improved Sash Stopper;* George H. Gray, Sr., Clinton, Hinds county, Mississippi, April 2.

Claim.—"What I claim as my invention, is the arrangement substantially as described, in one compact and connected mechanism, of a pair of oppositely acting eccentric tumblers, held in contact with the jamb by a single spring or its equivalent, and both operated by the same key or other usual substitute, and so disposed and constructed as to oppose any attempt (except by one who has control of the catch) to either raise or lower the sash from the position in which it may be placed."

13. For the *Construction of Drill Teeth in Seed Planters;* Levi Haversticke, Manortop, Lancaster county, Pennsylvania, April 2.

The patentee says,—"My invention consists in attaching the seed tube or shank of each share to its respective share-beam by a hinge, the shank being also connected with the share-beam by an adjustable spring coupling sufficiently rigid to hold it, with its share, in the proper position for forming a furrow in earth, but which, when the share strikes an obstacle that would otherwise break the machine, being detached by the strain from the shank, allows the latter to turn backwards and pass over the obstacle. My machine is constructed to discharge the seed in a continuous stream, the rate of discharge being regulated by a register; it is also so arranged that any one or all the shares can be raised from the ground at will, while at the same time the discharge of seed to each share is stopped by the act of raising it."

Claim.—"What I claim as new, is the spring coupling constructed and arranged substantially as set forth."

14. For an *Improved Attachment of the Forge Hammer to its Helve;* Daniel Hicks, Duncansville, Blair county, Pennsylvania, April 2.

Claim.—"What I claim as my invention, is limiting the depth of that portion of the hole in the helve which receives the shank of the hammer, and at the same time making the crown solid, excepting a hole of sufficient size through the same to admit of a punch, substantially in the manner and for the purpose herein described."

15. For an *Improved Oscillating Self-Adjusting Railroad Frog;* John W. Hoffman, Philadelphia, Pennsylvania, April 2.

Claim.—"What I claim as new, is a railroad frog, constructed, applied, and operating essentially in the manner and only for the purpose herein set forth."

16. For an *Improved Revolving Plate and Tumbler Lock;* Lewis Jennings, City of New York, April 2.

The patentee says,—"The first part of my invention consists in arranging within a cylindrical cavity a series of permutation plates, each pierced with a central hole to receive the entire body of the key, and with a projection therein to receive the action of the key, and with a recess or recesses in the outer periphery to receive a tumbler when all of them have been brought around to the proper point, the key being made of a series of plates corresponding in number with the permutation plates, and each having a recess of different length to act in succession on the permutation plates, to bring them to the proper position for the reception of the tumbler, one of the series of plates being cam-formed for the purpose of operating the tumbler.

"The second part of my invention consists in arranging the permutation plates and tumbler within a rotating cylinder or other case, surrounded by a permanent flanch or case properly recessed for the reception of the tumbler when held out by the permutation plates, to prevent the said rotating cylinder or case from turning when locked.

"The third part of my invention consists in arranging with the rotating case or cylinder which contains the permutation plates and tumbler, an eccentric fitted to a yoke on the bolt, for the purpose of throwing the bolt, the eccentric being at the dead point when the bolt is thrown out, that any pressure applied directly to the bolt to force it in, may have no tendency to turn the eccentric, and also with the view to render the whole lock compact.

"And the last part of my invention consists in making the recesses in the plates of the key of different lengths, but all starting from the same line, to bring the permutation plates in the proper position for inserting and withdrawing the key."

Claim.—"What I claim as my invention, is the arrangement of a series of permutation plates in a line and on the same axis of motion, each having a central hole for the reception of the entire key, and a projecting tongue for the key to act upon, and a recess or recesses on the periphery for the reception of the tumbler; but this I only claim in combination with a tumbler attached to, and rotating with, the cylinder, substantially as herein described.

"I also claim making the recesses of the key plates, or the equivalent thereof, of different lengths, but all starting from the same line, substantially as herein described, to facilitate the insertion and removal of the key, as described.

"I also claim the cylinder which contains the permutation plates, and which carries the tumbler as above described, in combination with the permanent flanch enclosing the same, and having a recess to receive and hold the tumbler when thrown out, substantially as described.

"And finally, I claim the arrangement of the eccentric for throwing the bolt, with the rotating cylinder carrying the tumbler and containing the permutation plates, as described."

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17. For an *Improvement in Agitating Coal Grates;* Abel Keeney, Carlisle, Cumberland county, Pennsylvania, April 2.

Claim.—"What I claim as new, is giving the compound vertical and horizontal oscillating motion to the grate-bars, as herein set forth."

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18. For an *Improved Blind and Shutter Opener and Fastener;* Jabes F. Lawrence and Luke A. Farnsworth, Claremont, Sullivan county, New Hampshire, April 2.

Claim.—"What we claim as our invention, is the opening and closing of window blinds, and retaining them when open or closed, by means of the rotary opener, (which is circular at its centre and gradually enlarges into scroll-shaped extremities, having a groove in its surface extending spirally from one of its scroll-shaped terminations to the other,) combined with the arm secured to the window casing, and the lever made fast to the blind, substantially in the manner set forth."

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19. For an *Improvement in Rotary Churns,* Osbert B. Loomis, Windsor, Hartford county, Connecticut, April 2.

Claim.—"What I claim as my invention, is the devices of gearing as described, by which I change the motions of the churn-box and dasher with regard to each other, so that while one is stationary the other shall rotate, and *vice versa.*"

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20. For an *Improvement in Spring Mattresses;* John V. McElvee, Philadelphia, Pennsylvania, April 2.

The patentee says,—"My invention consists in the construction of the skeleton foundation by which to combine together the springs, to complete a superior spring or elastic mattress."

Claim.—"What I claim as my invention, is constructing a spring mattress that the springs of the same shall project outwards beyond the light frame-work which supports them in their places, so that the whole upper and under surface, as well as the edges of the mattress, shall present a yielding surface to the touch by means of the projecting springs.

"I also claim the manner of constructing the hair-quilted upper or under coverings of the springs, as set forth: that is to say, the hair covering which rests on or against the springs is first made separately like a quilted bed spread, and then drawn over the springs, by which the mattress, though long used, preserves a uniform and elastic surface."

21. For *Improvements in Cat-Head and Shank Painter-Stoppers;* Charles Perley, City of New York, April 2.

Claim.—"I claim as new, the application of the lock-piece with the wedge or lug, to act in the mortise to hold the link on the lug, when put down for that purpose, or let the anchor 'go' by raising it, without the intervention of any other moving part; such lock-piece and lug or wedge being connected or combined and operating with the other parts, substantially in the manner and with the effects described."

22. For an *Improved Surface Condenser for Steam Engines;* Joseph P. Pirsson, City of New York, April 2.

The patentee says,—"My invention consists in certain improvements in condensers of steam machinery, whereby the boilers used for generating the steam shall be supplied with pure water, or water freed from saline or other foreign substances."

Claim.—"What I claim as my invention, is the combination of a surface or radiating condenser with a box or case, in such a way that the condensation of the steam shall be effected therein without subjecting the said radiating condenser to atmospheric pressure, in the manner described.

"2d, I claim the aperture or its equivalent, for maintaining the equilibrium, and as a passage of any steam which may remain uncondensed in the radiating condenser, in the manner set forth.

"3d, I claim connecting the evaporator with the chamber, substantially in the manner described, whereby I am enabled to draw off the saturated water from the bottom of the evaporator."

23. For an *Improvement in the Manufacture of India Rubber Springs for Cars, &c.;* Fowler M. Ray, City of New York, April 2.

The patentee says,—"The nature of the first part of my invention consists in rolling up on a mandril, and under pressure, a thin sheet or sheets of metallic India rubber, whilst in the green and heated state, until the required diameter has been obtained.

"And the second part of my invention consists in combining with the usual callendering rollers used in the manufacture of metallic India rubber, a mandril on which the said thin sheet of India rubber is wound as it comes from the heated callendering rollers, the said mandril being made to bear and turn on the surface of a cylinder below."

Claim.—"What I claim as my invention, is the method of making cylinders or rolls of prepared India rubber, by rolling up a thin sheet of prepared India rubber on a mandril whilst the said sheet is in a green state, and as it comes from the heated callendering cylinders, substantially as described.

"And I also claim as my invention, in combination with the callendering cylinders, such as are usually employed in the manufacture of prepared India rubber, a mandril or cylindrical rod pressed against the periphery of a cylinder or roller, so that the thin sheet of prepared rubber, in the green state and taken as it comes from the callendering cylinders, may be wound up on the mandril, and the several windings made to adhere by pressure, substantially as described."

24. For *Improved Removable Teeth for Scrapers;* Joseph Sweet, Hughesville, Lycoming county, Pennsylvania, April 2.

Claim.—"What I claim as my invention, is securing the removable teeth to any common scraper in the manner herein set forth, so that they can be attached and detached at pleasure, whereby the same scraper is adapted to ordinary earth excavation, or to the excavation of gravel or cobble stones, as described."

25. For an *Improved Mantel Piece;* Hiram Tucker, Cambridge, Middlesex county, Massachusetts, April 2.

The patentee says,—"The nature of my invention consists in forming a mantel piece of glass or similar material, properly ornamented on its back by paint or otherwise, and surrounded and guarded by a cast iron frame-work which shields the glass from injury by accident; said metal frame serving at the same time as an ornament, which can be highly elaborated into any pattern that the fancy of the manufacturer may suggest; by means of which I am enabled to form mantel pieces of the greatest beauty and durability, at a comparatively small cost to which they could be made in any material before used for that purpose."

Claim.—"What I claim as my invention, is the manufacture of mantel pieces by the combination of cast iron frames of ornamental open work, with a back or ground work of plate glass or other vitrified substance, colored in imitation of marble or after any other style of decoration; the said ground work being secured to the frames by means of plaster of Paris, or any other means that gives strength and support to the whole, substantially as described."

26. For a *Spring, Inclined Plane, and Roller Sash Stopper;* Seth E. Winslow, Kensington, Philadelphia county, Pennsylvania, April 2.

The patentee says,—"The nature of my invention consists in providing a roller of about one-half inch in diameter, and nearly the same in length, which is laid upon a metal spring of about six inches in length, and in width equal to the length of the roller. The spring is straight more than half its length; it then has an offset at nearly right angles equal to one-half of the diameter of the roller. It then is bent from the line of the spring outward to about twenty-two degrees, so as to form an inclined plane turned up at the end at a right angle with the body of the spring. In this depressed part of the spring or inclined plane is placed the roller by means of a slide, an axle passing through the roller and attaching it to the slide, so that when it is set in the window sash it operates in raising the sash as a friction roller, by rolling towards the bent end of the spring, but in lowering the sash it operates as a wedge or clog, rolling towards the offset or up the inclined plane, so as to prevent the window sash from falling."

Claim.—"What I claim as my invention, is the depressed form of the spring, or inclined plane, as I have called it, and the roller so adjusted to this depression by the slide, that in raising the window sash it operates as a friction roller, but in lowering the window sash it operates as a *clog* to keep it from falling, substantially as described above."

27. For an *Improved Arrangement of Door Springs and Levers;* William B. Barnard, Bristol, Hartford county, Connecticut, April 9.

Claim.—"What I claim as new, is attaching the spring and rod to the jamb of the door or standing part of the hinge, when combined with a swinging rod attached to the door or swinging part of the hinge, all the parts being arranged substantially as described, whereby the spring tends to close the door until opened to its fullest extent and then acts to hold the door open."

28. For a *Composition for Covering Hams;* Horace Billings, Beardstown, Cass county, Illinois, April 9.

Claim.—"What I claim as my invention, is the formation of a preserving composition for coating meats, fruit, vegetables, &c., by the union of rosin, shellac, and linseed oil, substantially in the manner and nearly the proportions as set forth."

29. For an *Improvement in Dividers or Compasses;* Homers & Ladd, assignees of Dexter H. Chamberlain, Boston, Massachusetts, April 9.

The patentee says,—"The distinguishing feature in my improved compasses, consists in the adaptation of what is called a micrometer adjustment of a peculiar kind to one of the legs, by which it may be moved with regularity a little distance, as is often very desirable among machinists and joiners where the radius of any specific or determined arc or circle is to be used."

Claim.—"What I claim as my invention, is making dividers or compasses with the micrometer adjustment herein above described, the combination of devices for the same consisting of a circular rack bar, arranged in slots in the legs of the divider, with a spring in the slot of the movable leg and the micrometer screw, all working together as herein above specified."

30. For an *Improved Entrance to Bee Hives;* John E. Dalton and Thomas Stevens, New Vienna, Clinton county, Ohio, April 9.

Claim.—"What we claim as our invention, is the devices for opening and closing the entrance of the bee house in the manner set forth.'

31. For an *Improvement in Rings for Harness, &c.;* Andrew Dietz, City of New York, April 2.

The patentee says,—"The nature of my invention consists in the combination of a sliding bar or sliding bars, with a ring used in connexion with straps for harness or for various other purposes; the object of which is to prevent the cutting or wearing through of the straps by their friction on the ring, and also to allow the strap to move more freely around the ring."

Claim.—"What I claim as new, is the combination of a sliding bar or sliding bars, (either with or without guides or guide bars), with a ring, in the manner substantially as described, for the purpose of being applied to straps for harness or for any other purpose to which it may be applicable."

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32. For a *Process for Making Cast Steel;* Joseph Dixon, Jersey City, New Jersey, April 2.

The patentee says,—"The nature of my invention in the process of making cast steel directly from pig or cast iron, consists in partly decarbonizing the pig iron by cementation in an oven with pulverized oxide of iron, and then melting the partly decarbonized pig or cast iron in crucibles."

Claim.—"What I claim as my invention in the above process of making cast steel, is partly decarbonizing pig or cast iron in an oven stratified with pulverized oxide of iron substantially as described, and then melting such decarbonized pig or cast iron in crucibles substantially as described."

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33. For an *Improvement in Machinery for Making Wire Heddles;* Milton Finkle, Utica, New York, April 9.

The patentee says,—"The nature of my invention consists in providing additions to the machinery now used, by which the heddle is made complete and finished by one operation, in one and the same machine."

Claim.—"What I claim as my invention, is the before described arrangement, combination and adjustment with the said old machine of the additional wheel on the main transverse shaft, the pinion and the shaft moved by it, wheel on the other end of the shaft, the short shaft and the two wheels upon it, wheel P and its attachments, and the cutter attached to the pincers for trimming off the burr at the end of the heddle, and also the levers whereby the heddle is made complete in one machine at one and the same operation, or any other combination which is substantially the same thing and by which analogous results are produced.

"I also claim what is herein termed wheel P as herein described, and as shown in figures 2, 3, and 4."

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34. For an *Improved Method of Working the Pawl in Parallel Vises;* Jasper Johnson, Genesee, Livingston county, New York, April 9.

Claim.—What I claim as my invention, is the combination of the spring pawl and the metallic plate (or lever) with the foot of one of the crossed levers, by which the spring pawl is made to act upon and retain the rack bar when any article is grasped between the jaws of the vise substantially as set forth."

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35. For an *Improvement in the Fluid Level;* William G. Ladd, Jr., Cambridge, Middlesex county, Massachusetts, April 9.

The patentee says,—"My improvement consists in employing in lieu of the common cylindrical tube containing spirit, (and usually set in the edge or on one side of the bar of the piece of wood used,) a circular shallow vessel set in a proper mortise formed in one face of the said bar, said vessel or shallow cylinder being about half filled with quicksilver or some other liquid and hermetically sealed, and having a needle or indicator floating on the top of said liquid, the ends of which point to the number of degrees on an annular metallic dial surrounding the said shallow cylinder, and which is properly graduated for the purpose."

Claim.—"What I claim as my invention, is a level for determining a horizontal and perpendicular line and the inclination of any slope with the same, constructed substantially as herein above set forth; that is, with a shallow cylindrical vessel or a tube in the shape of an entire ring half filled with quicksilver or other liquid in combination with a graduated annular dial, whether a floating needle or indicator be used or not, the whole arrangement being substantially as herein above set forth."

36. For an *Improvement in Machinery for Cutting Screws on the Rails of Bedsteads;* Spencer Lewis, Tiffin, Seneca county, Ohio, April 9.

Claim.—"What I claim as my invention, is, 1st, the combination of the adjustive clasp, screw and holder, for suspending and confining the nut to the end of the rail and centering the same so that the axis of the nut shall always be coincident with the centre of the rail, whether the latter be of large or small diameter substantially as set forth.

"I likewise claim the peculiar form and manner of securing the V cutter to the cylindrical head as described; that is to say, making the cutter as represented, and letting the tapered end of the shank into the recess, bringing the angular shoulder against the cylinder and sustaining the beveled points against the interior beveled surface of the cylinder head, by which arrangement the instrument during the operation of cutting is forced firmly against the head, the strain upon the confining screw being thereby greatly reduced and the cutting tool itself strengthened."

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37. For an *Improvement in Harness Hames;* John Low, New Britain, Hartford county, Connecticut, April 9.

The patentee says.—"My improvement consists in making the whole of the outside of the hames of a single piece of wrought iron, drawn out into and turned as a scalp, into which I fit a piece of wood of the proper shape without any regard to quality, and turn or bend the edges of the scalp over it so that the edge of the scalp come directly together, completely covering or inclosing the wood, and thus presenting an entire iron surface ready to be finished (or otherwise) as fancy, &c., may direct."

Claim.—"What I claim as my invention, is making the hame of a single piece of wrought iron, inclosing a piece of wood in such a manner as to present an entire iron surface, so that it may be readily finished in any convenient or ornamental way, and in a durable manner when the hame is constructed substantially as herein above described."

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38. For a *Process of Making Paint from Bituminous Coal;* Charles Mortimer, Philadelphia, Pennsylvania, April 9.

Claim.—"What I claim as new, is the process of making black paint from bituminous coal, by the cleansing in water, grinding, mixing with acid, regrinding in acid, and washing, substantially as set forth."

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39. For an *Elastic Roller Sash Bearer;* Julius A. Pease, Philadelphia, Pennsylvania, April 9.

The patentee says.—"The nature of my invention consists in the combination and arrangement of an elastic roller, with a shaft through the centre, and a box for said shaft to play in."

Claim.—"What I claim as my invention, is the combination of an elastic roller with a shaft and box, the whole constructed and arranged as before described for the purpose of supporting a sash in any desired position."

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40. For an *Improvement in Gearing for Seed Planters;* Jacob Pierson, Wilmington, New Castle county, Delaware, April 9.

Claim.—"What I claim as my invention, is the employment of the latch plate in combination with the connecting plate, carrier and intermediate cog wheel, for alternately gearing and ungearing the cog wheel s on the axle of the planting cylinder, with the cog wheel on the hub of the driving wheel in the manner, and for the purpose described."

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41. For an *Improvement in Apparatus for Extinguishing Fires;* William H. Phillips. Langton Place, North Brixton, Surrey, England, April 9; anté, dated Dec. 4, 1844.

The patentee says.—"The invention consists in generating in large quantities and with great rapidity, carbonic acid gas and other gases resulting from combustion, and discharging such gases while intermixed with steam or vapor of water upon or about any burning mass, and diffusing the same into the atmosphere where fire is burning for the purpose of subduing and extinguishing fire."

Claim.—"What I claim is the means of subduing and extinguishing fire by generating carbonic acid gas and other gases resulting from combustion in apparatus, substantially as herein described, and applying them by the pressure of their generation to the purposes above described."

42. For an *Improvement in Scale Beams;* E. and T. Fairbanks & Co., assignees of William P. Pierce, St. Johnsbury, Caledonia county, Vermont, April 9.

Claim.—"I claim in combination with the beam and the knife edge bearings of the loop, the two vertical or nearly vertical projections, salients, or knife edges, as arranged with respect to the loop and beam substantially in the manner and for the purpose specified."

43. For an *Improvement in Endless Aprons for Threshers;* Adkins Nash, Logansport, Cass county, Indiana, April 9.

Claim.—"What I claim as my invention, is the endless grating composed of bars secured to the hide or leather straps by twisting the latter in the manner and for the purposes set forth."

44. For an *Improvement in Hydraulic Regulators for Machinery;* Leman B. Pitcher, Syracuse, Onondaga county, New York, April 9; anté dated March 23.

Claim.—"What I claim as my invention, is the combination of pump *moved with a reciprocal motion* with the machinery sought to be regulated, and with the water or fluid acting on the piston and parts connecting it to steam valve, which controls the steam moving said machinery in such a manner as to cause the piston to rise and fall at each action of pump without moving the valve, while the machinery has the proper speed, and moving or opening, or closing said steam valve with a quick striking motion overcoming friction about said valve as with the blow of a hammer when the motion of said machinery is too fast or too slow, or any analogous arrangement which will produce the same result substantially in the manner and for the purposes and objects set forth."

45. For an *Improvement in Apparatus for Sprinkling Streets, &c;* Joseph D. Price, Smithsburg, Washington county, Maryland, April 9.

The patentee says,—"My machine consists of a revolving vessel by which the water is carried, and from which it is drawn by force pumps; the latter being operated by the revolving vessel, expel the water in a shower through numerous perforations in a curved pipe at the hinder end of the machine, thus sprinkling a broad strip of ground as the machine is drawn forward."

Claim.—"What I claim as new, is the combination of the sprinkling pipe and force pumps with the revolving water vessel, the several parts being arranged and operating substantially as herein set forth."

46. For an *Improvement in Plough Cleaners;* James F. Reasin, Darlington, Harford county, Maryland, April 9.

The patentee says,—"My invention consists in a device for cleansing ploughs or standards, which is composed of a stationary shear blade attached to the plough beam and projecting forwards from the coulter, and of a corresponding movable shear blade adapted thereto which can be operated when necessary by the hand of the ploughman, in such a manner that the weeds or other obstructions which are continually accumulating in the angle formed by the beam, and the coulter are divided into two portions which fall to the ground on each side of the coulter and leave it free to pass through the sod."

Claim.—"What I claim as new, is the plough cleanser, constructed of two shear blades substantially as herein set forth, for the purpose of cutting in two the weeds and other obstructions which accumulate upon the coulter and thus detaching them therefrom."

47. For an *Improvement in Chimney Caps;* S. H. Lombard and A. M. Rice, assignees of Augustus M. Rice, Boston, Massachusetts, April 9.

Claim.—"What I claim as my improvement, is a ventilator made with the helical continuous fender or guard applied to the chimney or flue, and having its coils arranged or inclined with respect to one another substantially as specified."

48. For an *Improvement in Oil Cans;* David G. Starkey, City of New York, April 9.

The patentee says,—"The nature of my invention consists in constructing a can or reservoir for holding the oil which is susceptible of being collapsed by the pressure of the hand, and which will on the pressure being removed resume its original shape without the aid of any internal springs, or other mechanical contrivance, as is usual in all other cans at present in use which are made to feed by external pressure."

Claim.—"I claim the combination of the socket carrying the male screw and the taper tubes or spouts screwing into the socket with the collapsible gutta percha reservoir, in the manner and for the purpose described or in any way substantially the same."

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49. For an *Improvement in Machines for Raking and Loading Hay;* Benjamin M. Townsend, Quincy, Adams county, Illinois, April 9.

The patentee says,—"The nature of my invention consists in combining a toothed rake by which the hay is gathered, with elevating bands which take the hay from the rake teeth and elevate it into the body of a hay wagon connected with the raker."

Claim.—"What I claim as my invention, is the simultaneous raking and loading of the hay from the ground by machinery, substantially as herein set forth, whereby the labor of making windows and cocking as in the usual process of hay making is saved, at the same time that the operation is both expedited and cheapened."

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50. For an *Improvement in Wing Gudgeons;* Mark Wilder, Princeton, Worcester county, Massachusetts, April 9.

The patentee says,—"The object of my improvement is to so construct the wing gudgeon as to render it when applied to a shaft very difficult to get displaced or out of centre, as so frequently occurs with those winged gudgeons as otherwise constructed."

Claim.—"What I claim is the improvement of making the wing gudgeon, when cast or founded with a clear space between each of the wings and the flanch or face plate, the same being for the purpose herein above set forth."

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51. For an *Improvement in Guitar Heads and Capo d'Astra;* James Ashborn, Wolcottville, Litchfield county, Connecticut, April 16.

The patentee says,—"The first part of my invention consists in winding the strings on spindles that pass through and turn in the head of the guitar handle, which spindles are of an enlarged diameter below the head, where these are combined with pins of the usual construction by means of cords attached to and wound around both, the pins being of less diameter than the enlarged part of the spindles with which they are combined or connected, thereby increasing the leverage of the pins to overcome the tension of the strings, whilst at the same time the tendency to turn back the pins by the tension of the string is greatly reduced.

"And the second part of my invention consists in combining with the capo d'astra or plate for pressing the strings on to any particular part of the handle, a metal or other strap attached thereto and passing down on each side of the handle, and an eccentric roller journalled to the said strap and acting against the under surface of the handles, so that the said plate may, with one hand only, be drawn down on to the strings and adjusted or liberated therefrom by simply turning the said roller, the whole thing being put on and pushed back on to the head beyond the last fret, where it does not interfere with the vibration of the strings."

Claim.—"What I claim as my invention, is the method, substantially as herein described, of tuning guitars by winding the strings each on a spindle, having a part below the guitar head of an enlarged diameter connected and combined with a peg of the usual construction, by means of a cord in the manner and for the purpose substantially as described.

"I also claim combining an eccentric roller with a capo d'astra for moving and holding it down on to any desired part of a guitar handle, by means of a metal strap made to embrace the handle and capo d'astra plate and attached thereto substantially in the manner and for the purpose specified."

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52. For an *Improvement in Car Couplings;* Hiram Baldwin, Nashville, Hillsborough county, New Hampshire, April 16.

Claim.—"What I claim as my invention, is the combination of the draw iron, with the bearing, the bolt, the bed piece, and the wedge or key, in such manner that the draw iron makes a vertical joint with the bolt and the bed piece; and through the wedge or key all these joints are brought to any desirable rigidity of bearing.

"I claim this particular combination of the parts described, whereby a free but close horizontal and vertical joint is at all times maintained between the bodies to which it is attached, and especially the applications of couplings upon this construction to the connexion of locomotive engines and tenders."

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53. For an *Improvement in Machines for Breaking Hides;* Charles Bauchman, North Whitehall, Lehigh county, Pennsylvania, April 16.

The patentee says,—"My hide breaking and scouring mill consists of a series of cylinders revolving above a vat or cistern; each cistern is furnished with a beater which is alternately raised and allowed to fall upon the barrel of the cylinder beneath it; the latter is studded with blunt pins or bosses and the face of the beater is studded with similar pins which correspond in position with the spaces between those on the cylinders; the cylinders also are so arranged with respect to each other, that the pins on one intervene between those of the others."

Claim.—"What I claim as my invention, is the breaking of hides, the working out of the lime and the bate, and the scouring of the tanned hides by means of revolving cylinders and beaters, substantially as herein set forth."

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54. For an *Improvement in Cast Iron Car Wheels;* James Boon, Lancaster, Lancaster county, Pennsylvania, April 16.

Claim.—"What I claim as my invention, is the casting a 'chilled railroad cast iron car wheel,' giving a uniform chill to the wheel by separating the arms from the rim of the wheel by the inverted flanches, forming a hollow rim, together with the combination of the arches or ovals as herein described; thus using the solid hub to the chilled wheel, adding strength to the whole and securing regularity in the wear."

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55. For an *Improvement in Hydraulic Blowers for Furnaces, &c.;* Ranson Cook, Saratoga Springs, Saratoga county, New York, April 16.

Claim.—"What I claim as my invention, is the combination of cavities or air cells, formed in part by the partitions on the periphery of the drum of the wheel or receiver of compressed air, with said drum or receiver, the exterior floating valves, the interior valves, and the hollow shaft, all forming parts of, or connected with a wheel to be turned when partially immersed in water, for the purpose of producing a blast of air through the hollow shaft, to be used in heating, smelting, and other manufacturing and mechanical operations."

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56. For an *Improvement in Grates for Cooking Stoves;* John T. Davy, Troy, New York, April 16.

The patentee says,—"The nature of my invention consists in the so arranging the curved grate in connexion with curved ash plate, as secured by letters patent of the United States granted to Samuel Pierce, July 31st, 1847, in such a manner as that the grate is raised so that the coals are let down into the summer arrangement for boiling and other purposes, and also the fire chamber is cleared of ashes in the same manner, and the grate by its own weight and curvature retains its proper position for retaining the fuel in the chamber,"

Claim.—"What I claim as new, is the manner herein described of arranging and combining the fire grate of cook stoves, with the front fire plate and curve plate, so that it shall retain its proper position for retaining the fuel in the chamber by its own weight, and shall be raised for removing coals and ashes substantially in the manner and for the purpose herein described."

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57. For an *Improvement in Submarine Telescopes;* Willard Day, Brooklyn, Kings county, New York, April 16.

The patentee says,—"The nature of my invention consists, 1st, in providing the main telescopic tube with an opening near its upper extremity to supply the lamps with air, to allow the use of a spy glass when required in combination with the main tube.

"2d, The construction of the mirror box of a square form with a glass in its bottom, below which there is an open recess to confine a portion of air between the glass or tight window in the bottom, and thus allow the bottom of seas, &c., to be examined through the chamber of the mirror.

"3d. The arrangement of the lamps on each side of the mirror in separate chambers, but with one folding glass door in front; and the supplying of the lamps with fresh air through the main tube, conducting it under the lamps to feed them and then conducting the smoke away by a separate passage."

Claim.—"I claim, 1st, the main tube constructed with the side opening in it to allow a spy glass to be used in combination with the telescope as herein set forth.

"2d, The mirror chamber constructed to allow the mirror to move through a space of about ninety degrees, and with a glass in the bottom of it in the manner substantially as herein described and for the purpose herein set forth.

"3d, I claim the arrangement of the lamps or artificial lights on each side of the mirror, and leading the feeding draught from the main tube to the lamps under the mirror and lamps; and carrying the smoke away through the separate passage in the manner substantially as herein described, or in any other manner substantially the same."

58. For an *Improvement in Preparing Clay for Brick Machines;* Charles M. Ferris, New Milford, Litchfield county, Connecticut; Nathan Swan, Paterson, Putnam county, New York, April 16.

Claim.—"What we claim as our invention, is the method of constructing the grinding apparatus or mill, in such a way, that the knives on the shaft shall be set so as to describe a spiral line at their junction with the shaft, in order that no two of them shall be able to pass between any two pairs in the curb at the same instant and under the same circumstances. It being understood that we do not claim, in general, this mode of setting the knives on the shaft, but only the use of the same in connexion with the fixed knives in the curb for the purpose specified."

59. For an *Improvement in Electro Magnetic Engines;* John H. Lillie, Juliet, Will county, Illinois, April 16.

The patentee says,—"My invention consists in the employment of a number of permanent horse shoe magnets, compound or single, revolving on a wheel in front of an electro magnet or magnets fixed stationary to the frame: and in conjunction therewith I employ a helix of fine wire around the outside of the electro magnet, for the double purpose of producing other electro magnets and to destroy the secondary or vibratory currents in my first electro magnet. I also employ a new and convenient pole changer, connected with the wheel of permanent magnets by gearing, as hereafter described."

Claim.—"What I claim as new, is, 1st, the employment of induced electricity as above stated, in producing magnetism in the secondary electro magnets, to be used as a motive power in connexion with the prime mover, and to neutralize the secondary currents of the principal magnets formed by the direct current from the battery.

"I claim the combination of the magnet changer and pole changer substantially in the manner and for the purpose set forth."

60. For a *Trap for Catching Flies;* Joel B. Fuller and George W. Pierce, Worcester, Massachusetts, April 16.

Claim.—"What we claim as our invention, is the application of the devices for conveying flies into a box, or vessel, by wheels or belts between floats or projections, moving either by a circular or straight forward motion in the manner and for the purpose specified."

61. For a *Combined Shutter and Sash Fastener;* Thomas Harvey, Baltimore, Maryland, April 16.

Claim.—"What I claim as my invention, is, 1st, the lever secured by a fulcrum pivot to the sill of a window frame, when it is so arranged that the hook at its outer end can be made to interlock with the holder made fast to the blind, and when in that position the inner end of the lever be so connected with the apparatus for fastening down the sash, that the lever cannot be operated without previously unfastening the sash, substantially as set forth.

"2d, I also claim the arrangement of the lever placed upon the window sill, the holder secured to the blind and the latch secured to the lower bar of the sash, by which, when the blind is closed and the window sash is raised, the descent of the sash will operate the lever and thereby securely fasten the blind, substantially as set forth.

"3d, I also claim the arrangement of the lever, the holder, the latch, and the spring catch, respectively secured to the sill of the window frame, and to the blind and sash, in such a manner that the closing of the sash will securely fasten it down, and at the same time operate and firmly retain the lever in such a position that it cannot be detached from its hold upon the blind without previously unfastening and raising the sash, substantially as set forth."

62. For an *Improvement in Carriages;* James Patterson, Franklinsville, Cattaraugus county, New York, April 16.

The patentee says,—"My invention consists, 1st, in connecting the perch with the fore axletree by means of a king bolt, which is in one piece with the perch and fixed ring of the fifth wheel, instead of by the loose king bolt usually employed for the purpose.

"2d, In the method of connecting the hind axletree with the perch, the parts being so arranged that while they are easily disconnectible they are not liable to work loose by the constant jar incident to the running of the wagon.

"3d, In the method of connecting the shafts or tongue with the fore axle, whereby the clips usually employed are dispensed with, and the thill-hangings or goose-necks of the shafts or the tongue are connected directly with the axletree which is made the axis on which they turn up and down."

Claim.—"What I claim as my invention, is making the king bolt, the fixed ring of the fifth wheel, and perch in one piece, whereby the liability to accident is diminished, and the durability of the parts is increased, as herein described.

"I likewise claim connecting the perch and its braces with the hind axletree, and the thills with the fore axletree, by screwing them into pipe-clips, as herein described, whereby the great number of screw bolts and nuts generally employed are dispensed with, and a cheap and durable connexion is obtained, which at the same time admits of the ready disconnexion of the parts."

63. For an *Improvement in the Construction of Bases for Stands;* Ezra Ripley, Troy, New York, April 16.

The patentee says,—"The nature of my invention consists in casting the whole base, and firmly fastening it together by means of one central rod passing from top to bottom."

Claim.—"What I claim as new, is the mode herein described of employing a base-piece, that the legs or feet may hook into and be held firmly in place by the cap plate and rod running through the centre, the same constructed and operating substantially in the manner and for the purpose described."

64. For an *Improvement in Piano Forte Action;* John Ruck, City of New York, April 16.

The patentee says,—"The nature of my invention consists in providing what I term a repeating spring tongue, to prevent the hammer from being disconnected with the fly lever after the hammer has made a strike.

"2d, To provide a regulating pin or screw for the inner end of the lever of each key, to regulate the length of, or strength of, the stroke to each key.

"3d, To provide a regulating set-screw, to regulate the height of the fly lever."

Claim.—"I claim the spring tongue, in combination with the under angular lever, for the purpose set forth, not limiting myself to the exact construction of it, as herein described, while the same effects by a like combination may be produced.

"2d, I claim the regulating screw for the purpose set forth, viz: to regnlate the strike key separately as set forth."

65. For an *Improvement in the Attachment of the Harrow to the Seed Planter;* Marcus Sage and Silas S. Sage, Windsor, Broome county, New York, April 16.

Claim.—"What we claim as our invention, is connecting with the machine a harrow constructed with spring teeth, so arranged by means of a slide hinge that the wheel track towards the land to be sowed can always be left undisturbed as an accurate guide in returning across the field."

66. For an *Improvement in the Gearing of Seed Planters;* Anthony Sandoe, Middletown, Juniata county, Pennsylvania, April 16.

Claim.—"What I claim as new, is, 1st, the sliding frame in combination with the rod for the purpose of raising and depressing the drills, and also for stopping the feeding simultaneously as above set forth.

"2d, I also claim operating the shut-off and lever by means of the arm as above set forth, for the purpose of causing the same to be self-acting, either when coming in contact with any obstruction, or when desired for sowing pointed or irregular lands."

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67. For a *Compound Tubular Rail;* Alfred B. Seymour, City of New York, April 16.

The patentee says,—"My invention consists in making the inner face of each of the two parts with a longitudinal recess, so that when the two parts are united they shall constitute a tube, into which blocks are fitted at the junctions of the different sections to add strength and stability to the rail."

Claim.—"What I claim as my invention, is the making of a two-part break-joint hollow rail, substantially as herein described; and in combination with the two-part rail, made hollow as specified, I claim the blocks inserted in such hollow at the junction of the sections, substantially as described."

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68. For an *Improvement in Sewing Machines;* Thomas Chadbourne, Concord, New Hampshire, assignee of David M. Smith, Springfield, Windsor county, Vermont, April 16.

Claim.—"What I claim as my invention, is the herein before described disposition of the thread eye of the needle: that is to say, the said eye being placed near the point of the needle, in combination with the afore described manner of supporting the needle, and applying it to the machinery which produces the corrugations or foldings of the cloth; not meaning to lay claim to the combination of a needle and gears, or other analogous contrivances for producing sewing, as the same have heretofore been applied and used, but meaning only to claim my improvement as constructed and made to operate substantially as specified."

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69. For an *Improvement in Cooking Stoves;* William Abendroth, Port Chester, Westchester county, New York, April 23.

The patentee says,—"The object of my invention is to distribute the heat as much as possible over the oven without disturbing the draft, and consists in carrying the products of combustion over the top of the oven from the fire chamber, the said products entering the flue immediately over the fire chamber, through an opening in the partition plate on the right hand side; thence they are carried down through a side flue on the left hand side of the oven; thence through a flue under the oven, which flue communicates with the air chamber between the fire chamber and oven; thence up the upright flue at the back to the exit pipe."

Claim.—"What I claim as my invention, is causing the heat and products of combustion to enter the flue over the oven on one side, and carrying the same across the top of the oven down the other side thereof in a broad sheet, thence under the oven, and thence up in a broad flue to the smoke pipe, substantially as described."

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70. For an *Improvement in Churns;* John Andrews, Woburn, Middlesex county, Massachusetts, April 23.

Claim.—"What I claim as my invention, is the combination of the external chambers, their plungers and discharging passages, with the middle or air chamber; the whole being constructed, applied, and used substantially as specified.

And in combination with the above, I claim the air-entering passages, applied and used substantially in the manner and for the purpose set forth."

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71. For an *Improvement in Dentists' Chairs;* A. Merritt Asay, Philadelphia, Pennsylvania, April 23.

The patentee says,—"The nature of my invention consists in constructing a deep bottom or seat to a common arm chair, consisting of an external box in which is the following machinery, to wit, a wheel cogged on the upper surface and periphery, working on an axle affixed to the bed or under part of the box; said wheel is used to turn 2, 3, or 4 male screws, which screws are furnished with small cog wheels at the lower end, working into the cogs of the above mentioned larger wheel, and into 2, 3, or 4 female screws, and running up into pipes in the seat or inner box intended to be elevated; the whole of which is moved by a winch, on which is a cogged wheel working into the cogs of the upper side of the larger wheel, and upon the winch being turned towards the left side of the chair the seat rises, according to the length of the screws, from 7 to 1[illegible], or even 20 inches."

Claim.—"What I claim, is the manner in which I arrange the operating parts within the frame-work and under the seat, in combination with the seat so made as to move up and down within the frame-work and appear like an entire seat, as herein set forth."

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72. For an *Improved Method of Attaching the Cylinder in Revolving Fire Arms;* Thomas J. Whittemore, Cambridge, assignee of Dexter H. Chamberlain, Boston, Massachusetts, April 23.

Claim.—"What I claim, is the improved mode of attaching the cylinder of barrels to the stock, viz: by means of the cylindrical tube, in combination with the flanch and stud, or their equivalents, whereby I dispense with the usual spindle, and hole for its reception, in the centre of the cylinder of barrels, being thus enabled to enlarge the bore of the barrels in a cylinder of equal size."

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73. For an *Improvement in Machines for Drilling Stone;* George Fletcher, Sr., Greensburg, Decatur county, Indiana, April 23.

The patentee says,—"The nature of my invention consists in a method of rotating the drills between each stroke."

Claim.—"What I claim as new, is the combination of the lever with the cranks and pitman which operate it, for the purpose of rotating the drill periodically by impingement against the cogs of the pinion at its greatest elevation, returning to position when the pinion is removed from its range; the whole arranged and operated substantially in the manner and for the purpose set forth."

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74. For a *Submerged Rocker for Separating Ores;* Oliver Edes, Plymouth, Massachusetts, April 23.

The patentee says,—The nature of my invention consists of a frame into which is fitted any required number of pans, which can be removed and replaced at the pleasure of the operator; the frame is provided with pivots or journals which have bearings in the ends of levers or arms attached to a box-boat or platform, in such a manner that the frame carrying the pans can be lowered into, or raised from, the water; the earth to be washed is placed in the pans and lowered below the surface of the water, and the frame carrying the pans is rocked by means of a lever operated by a person in the box or boat, or upon the platform, to which the frame may be attached."

Claim.—"What I claim as new, is the combination of the rocking frame, the pans, the levers, and the bars, attached, secured, and adjusted to the box, or to a platform or boat, in the manner and for the purposes substantially as herein described."

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75. For an *Improvement in Safety Lamps;* John W. Hoffman, Southwark, Philadelphia county, Pennsylvania, April 23.

Claim.—"What I claim as my invention, is the sliding tubes, in combination with the screw, the said screw being furnished with the opening through which to fill the lamp, substantially in the manner and for the purpose described."

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76. For an *Improvement in Double Cooking Stoves;* Henry Jackson, Evansville, Vanderburgh county, Indiana, April 23.

The patentee says,—"The nature of my invention consists in the construction of a cooking stove having two distinct compartments, with such an arrangement of the fire chamber, grate, and the flues, that one compartment receives a far higher degree of heat than the other, thus permitting boiling, roasting, or any kind of cooking requiring much heat, to be carried on in one part of the stove, while at the same time baking, or any kind of delicate cooking requiring a regular and low degree of heat, may be conducted in the other part."

Claim.—"What I claim, is the construction of a double cooking stove having two compartments, and a smoke flue passing round one compartment first and then around the other, in such manner that one shall be heated in a much higher degree than the other, arranged and constructed substantially as herein described, and for the purposes set forth."

77. For an *Improved Arch Truss for Bridges;* Henry Lanergan, Boston, Massachusetts, April 23.

Claim.—"I do not claim a series of arched supporting beams constructed as herein specified, but what I do claim, is the so combining or arranging them with respect to each other, and with the radial suspension rods, and on the chord or beam to which they are applied, that they and their suspension rods may overlap one another, and have the feet or parts of each which rest on the chord upheld by the crown and suspension rods of the central part of an adjacent arch, all substantially as specified."

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78. For an *Improvement in Coal Stirrers for Furnace Grates;* William R. Nichols and Burritt C. Boyes, Philadelphia, Pennsylvania, April 23.

The patentees say,—"The nature of our improvement is such as to avoid all direct contact of the solid fuel with the metallic plates composing the boiler, to form the grate in such manner as to be exposed on all sides to currents of air which may keep its temperature so low as to avoid burning out the bars, and to allow its contents to be kept sufficiently open for maintaining combustion. This latter effect is produced by a series of vertically moving rake teeth, or fingers moving vertically endwise, and actuated either by hand, (through the lever,) or by the action of the engine: when moved by the engine, they are furnished with machinery for regulating the extent of their upward movement or for throwing them out of action altogether."

Claim.—"What we claim as new, is, 1st, the rake frame, having numerous vertically moving fingers, constructed and operating to stir and clean the fire only by a vertical movement; said fingers being distributed beneath the grate, substantially in the manner and for the purposes described.

"2d, We also claim, in combination with the passages round the rim of the grate, admitting warm air above the fire, the vertically moving rake teeth which open passages for the free escape of combustible gases to be burned by said warm air, thereby maintaining a copious volume of flame all around the interior of the fire box, as herein set forth."

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79. For an *Improvement in Cotton Gins;* Stephen R. Parkhurst, City of New York, April 23.

Claim.—"What I claim as new, is, 1st, the making card cylinders, with gutta percha or other similar substance filled in among the teeth, to form a regular surface and stiffen the teeth, whether such cylinders so filled are used for this or any other purpose for which they are available.

"2d. I claim the application of one or more card cylinders, with gutta percha or other similar substance between the teeth, in connexion with an equal number of smooth cylinders, to card cotton from the seed, substantially as described and shown.

"3d. I claim the application of the wire gauze drum and roller beneath, first, for the purpose of allowing the blast to drive the dust and chaff from the cotton, and second, for the purpose of leading the cleaned cotton out in a sheet or bat, whether this roller and drum be applied to act with card or with the common saw gin."

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80. For an *Improvement in Piano Fortes;* John Ruck, City of New York, April 23.

The patentee says,—"My invention consists in constructing the tuning blocks of piano fortes by combining wood and metal in such a manner as to give great firmness and strength, and render them capable of bearing the great strain of the strings without yielding or losing their shape; and in providing rests or bearings for the strings which will prevent any shaking or jarring.

"I construct the tuning blocks of a number of pieces of wood, so arranged and united as to prevent the liability to warp, and I attach a plate of metal to its upper surface, having a series of ribs attached to, and forming part of, the plate; these ribs form the bearings for the strings, which rest each on the upper side of one of the ribs and pass through a hole in the rib next to it previous to being wound on the tuning pins."

Claim.—"I claim the manner of constructing the tuning block, substantially as herein described, of the arched slab and back piece, with the wedge or piece, and the diagonal bolts or keys, whereby it is made capable of withstanding the great strain of the strings.

"And I also claim the metal plate carrying the ribs projecting from and forming part of it, the plate being attached to the upper surface of the tuning block, each of the strings of the instrument passing over and resting on a rib, and passing through a hole in the rib immediately behind, whereby I obtain a solid bearing on the tuning block, which will make them produce a full round clear tone."

81. For an *Improvement in Brick Presses;* Nathan Sawyer, Baltimore, Maryland, April 23.

The patentee says,—"This invention consists of a combination of a series of properly formed moulds in a revolving cylinder, in which pistons are worked as said cylinder revolves against a stationary cam by which the pressure upon the bricks is produced."

Claim.—"What I claim as new, is 1st, the combination of the grated disk and hopper, constructed and arranged substantially in the manner and for the purpose set forth, and in combination with the revolving moulds.

"2d, I claim the arrangement of the moulds (whether conical or otherwise, as before patented) in a revolving cylinder, with pistons revolving with them and working under a stationary cam as herein described, in combination with stationary cutters, or cutters revolving on their own axes, working in a groove near the lower ends of the moulds and also below the moulds in the manner and for the purposes set forth.

"3d, I claim the apparatus for trimming the bricks, consisting of a stationary cutter and a piece in front thereof to press up against the brick as the clay is cut.

"Lastly, I claim the combination of adjustable headed pistons with stationary cam, as specified."

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82. For an *Improved Arrangement of Propellers and Chimnies for Canal Boats;* Benjamin M. Smith, Ridgeway, Orleans county, New York, April 23.

The patentee says,—"The principle or character of the first part of my invention consists in the use of two propellers in a recess at the stern of a boat, one of said propellers being vertically above and back of the other, whereby a greater amount of paddle surface can be obtained within a case and in a vessel having a narrow stern than by any other known plan, and by which also the propellers are adapted to different draughts of water, the lower one of said propellers being at all times entirely submerged, and the other only in part.

"And the second part of my invention consists in combining with the propellers located and arranged as herein described, a suction or exhausting fan (which is located between the furnace and the end of the flue or chimney at which the combustion is discharged) for exhausting the flues of the steam boiler furnace, so as to produce the required draft when the said exhausting fan is connected by a pipe with the recess in which the propellers are located.

Claim.—"What I claim as my invention, is the employment in combination of two propellers arranged in a recess at the stern of a boat, each being on a separate shaft one above the other, and one of the propellers being placed back of the other substantially as herein described, whereby a greater amount of paddle surface can be obtained within a case and with a given width of stern than by any other known plan.

"And I also claim in combination with the propellers arranged with a part of one of them above the water line, and enclosed in the recess at the stern of the boat, substantially as herein specified, the employment of a fan for exhausting the chimney of the steam boiler furnace, and for discharging the products of the combustion into the recess in which the propellers work substantially in the manner and for the purpose specified."

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83. For a *Lathe for Turning a Peculiar Species of Curve;* Henry G. Thompson, City of New York, April 23.

The patentee says,—"The nature of my invention consists in combining with the mandrel of the lathe or the shaft of the steam wheel to be turned, a cutter stock which, in addition to the usual progressive motion in a line parallel with the axis of the mandrel or shaft, shall have a reciprocating motion towards and from the axis of the mandrel or shaft, to be communicated by a crank the shaft of which is rotated by a pinion having cogs which engage the cogs of a wheel on the mandrel or shaft."

Claim.—"What I claim as my invention, is the method substantially as herein described, of turning the periphery of steam wheels or other articles with regularly curved projections and depressions from a true circle, by combining with the mandrel of a lathe or (what is equivalent thereto) the shaft of the steam wheel, a cutter, which in addition to the usual longitudinal motion parallel with the axis receives a reciprocating motion towards and from the axis by means of a cog wheel and pinion and crank, or their equivalent, as herein dedescribed."

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84. For an *Improvement in Smut Machines;* David Ulam, Mount Pleasant, Westmoreland county, Pennsylvania, April 23.

The patentee says,—"The one part of my invention consists in provisions for the adjustment and renewal of the concave toothed or grooved rubbing surface, which acts in conjunction with the tooth covered drum rotating within it to scour the grain and separate the smut therefrom.

"Another part of my invention consists in arrangements for directing and regulating the issue of the blast, also a part for carrying off the chaff, dirt, &c., from the grain.

"Likewise an arrangement for sustaining the rubbers in a proper position."

Claim.—"What is claimed as new, are as follows:—The peculiar construction of the rubber pieces, substantially as described, whereby all parts of their surfaces may be successively appropriated to the rubbing action, each plate being susceptible of four changes before it becomes necessary to replace it by a fresh rubber."

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85. For an *Improvement in Brick Presses;* Shepherd Whitman, New Albany, Floyd county, Indiana, April 23.

Claim.—"What I claim as my invention, is the clearer as used in connexion with the two plungers, for the purpose of delivering the brick and preventing the plungers from becoming foul at their passing ends, and the clearer itself being kept clean and polished by the action of the plunger upon its lower surface."

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86. For an *Improvement in Instruments for Measuring Cloth;* E. F. Whiton, West Stafford, Tolland county, Connecticut, April 23.

The patentee says,—"The nature of my invention consists in a roller mounted on a shaft capable of revolving in fixed bearings, and carrying an endless screw gearing into the toothed periphery of a wheel or traveler revolving on a fixed spindle or stud placed vertically or at right angles to the shaft carrying the roller and endless screw. On the same fixed stud is a circular graduated index plate which may be turned to any position on the axis of the fixed shaft, but will not be moved by the revolution of the traveler; the cloth to be measured passes over the roller, causing it to rotate, thereby communicating rotary motion to the traveler, which carries a finger or indicator pointing to the graduated index plate, and denoting the distance traveled by the periphery of the revolving shaft and the number of yards which have passed over the roller."

Claim.—"What I claim is the manner herein described of measuring cloth or other fabrics, by causing the material to pass over and give rotary motion to the roller, carrying on its axis the endless screw gear, gearing into the teeth of and giving motion to the traveler wheel, carrying an indicator, pointing out the distance traveled by the periphery of the roller on the graduated adjustable index plate or by any other mechanical combination substantially the same."

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87. For an *Improvement in Adjustable Shears of Corn Plough;* David Wolf, North Lebanon, Lebanon county, Pennsylvania, April 23.

Claim.—"What I claim as new, is increasing or diminishing the angle of the ploughs with the central line of draft, by shifting the screws K′ to the holes in the ploughs and the screws L′ to other holes in the beams without changing the position of the shanks and braces, by which more or less earth may be thrown toward the row of plants under culture, as described."

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88. For *Improvements in Changing a Reciprocating Motion into a Rotary Motion;* Peter Yates, Milwaukie, Wisconsin, April 23.

Claim.—"What I claim as new, is the application of the levers, catch blocks, with the bevels and springs, or their equivalents, to interlock and unlock with the crank arms.

"And I claim also making the governing bar adjustable in combination with the levers in such a manner as to give either a direct or reversed motion to the pulleys. And I claim the above applications, severally, and in combination in the whole and in the parts, the apparatus being constructed and operated substantially in the manner and for the purposes described and shown."

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89. For an *Improvement in Reed Musical Instruments;* Charles Austin, Concord, Merrimack county, New Hampshire, April 30.

Claim.—"What I claim as my invention, in reed musical instruments made with a sounding board, is, to make the reed opening directly through the wooden sounding board in combination with the applying of the reed directly to the same, and fastening it to the sounding board; instead of using any metallic frame for the opening and reed, as has been the customary method of making and constructing such instruments; my said invention by dispensing with the metal frame not only producing a remarkable improvement in the tone, but a great saving in the cost of construction of an instrument."

90. For *Coupling of Pipes and Hose;* A. Heyer Brown, Albany, New York, April 30.

Claim.—"I claim the construction of couplings for hose or tubing, by forming one part thereof into a hollow cylindrical cup or box having wedge shaped flanges of metal inside, and next to the edge thereof, and by forming the other part of the coupling of a flange equal in diameter to the first described coupling, having its face edge ground with the edge of the first coupling to make a tight joint. With a cylindrical ring (whose bore is equal to that of the tubes to be coupled) projecting from said flange, concentric with it, and in diameter just large enough to pass between the flanges of the cup or box, and to reach just to the bottom of the cup, whose bottom face with the outer face of said ring are ground together to form a tight joint. Also said ring having on its periphery at the outer edge, wedge shaped flanges similar in form and angle to the flanges of the cup or box, and so arranged as to pass between the intervals of the same; so that by being turned round underneath them they compress the ground surfaces of the couplings together firmly. The whole apparatus being in the former essentially set forth."

91. For an *Improvement in Apparatus for Drawing Water;* Cain Broyles, Greene county, Tennessee, April 30.

Claim.—"What I claim as my invention, is the plan described of bringing water upon a level over a hill, or in any situation where the fountain is not higher than where the water is wanted for use, viz:—I claim the combination of the weight, and its cord, pulley, and ring, with the cord by which the bucket is drawn, and the hook or catch upon the carriage, the whole being arranged substantially as described, for the purpose of drawing the empty bucket from the place of discharge over the highest point of the way to the spring."

92. For an *Improvement in Machines for Holding and Dressing Slates;* Samuel E. Crocker, Boston, Massachusetts, April 30.

Claim.—"What I claim is the endless series of clamp carriages operating substantially as set forth to hold and carry the slates beneath the cutters."

93. For an *Improvement in Grain Driers;* Martin R. Dudley, New Orleans, Louisiana, April 30.

Claim.—"What I claim as new, is the construction and arrangement of the apparatus as described, by which a stratum of air is forced into a case enclosing the grain cylinder where it protects the grain from the direct action of the heat from the fire, and is there heated and conveyed through the grain so as to carry off the moisture therefrom, substantially in the manner and for the purpose set forth."

94. For an *Improvement in Gearing for Regulating Speed;* Hosea Elliot, Manchester, Hillsborough county, New Hampshire, April 30.

The patentee says,—"My invention consists in the employment of the wheel or pulley for transmitting the speed of the cone to the governing shaft; by this means the different speeds of the cone is communicated to the compound with greater accuracy, requiring less care and skill in operating the machine and also lessens the expense."

Claim.—"What I claim, therefore, as my invention, is the employment of the wheel or pulley in combination with the cone or governing shaft, substantially in the manner and for the purpose herein set forth."

95. For an *Improvement in Gauges for Spreading Plasters;* James M. Keep, Bath, Lincoln county, Maine, April 30.

The patentee says,—"My apparatus consists of an adjustable table and clamp frame adapted thereto, both of which are capable of expansion and contraction to graduate them to the size of the plaster required, and so constructed and arranged that the leather or other material employed for the purpose is firmly held during the operation of overlaying it with the adhesive material by means of a heated iron; the material being evenly spread and leaving a border or selvedge around the edge of the plaster."

Claim.—"What I claim as my invention, is the combination of the adjustable expanding and contracting frame with the adjustable expanding and contracting bed, the several portions of the combination being arranged and constructed substantially as herein set forth."

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96. For an *Improvement in Let Off Motion in Looms;* Jonathan Knowles, Buffalo, New York, April 30.

The patentee says,—"My invention consists in a combination of mechanical devices, by means of which the warp is let off from the yarn roll in exact proportion to the amount of filling inserted, while the force with which the filling is driven up can be regulated in proportion to the closeness or fineness required in the cloth."

Claim.—"What I claim as my invention, is the arrangement of the yielding weighted and the stationary whip rolls in connexion with the let off motion as herein set forth, whereby the texture of the cloth is rendered more uniform than has been heretofore done while it can be varied at will."

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97. For an *Improvement in Hanging Saws in Saw Mills;* E. Henry Parsons and Sanford E. Parsons, Wilkesbarre Luzerne county, Pennsylvania, April 30.

The patentees say,—"Our invention consists in hanging the saw in advance of its front or cutting edge, in such manner that the pressure of the log advanced against it will tend to keep it in line with the direction in which the carriage is advancing, thus dispensing with the heavy saw gate usually required to strain the saw."

Claim.—"What we claim as our invention, is the method of hanging a mill saw from guides in advance of its front edge, which will sustain the whole pressure caused by the advancement of the wood on the carriage against the saw teeth, the plate of the saw swinging on the advanced guides as pivots, so that when cutting it is kept running in a plane passing through the guides in the direction in which the carriage moves, as a vane is kept by the wind in the direction in which it blows."

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98. For an *Improvement in Holding Daguerreotype Plates;* Samuel Peck, New Haven New Haven county, Connecticut, April 30.

Claim.—"What I claim as new, is the construction of a movable holder for securing daguerreotype plates, by pressure from within outwards while the plates are being polished, burnished, buffed, or cleaned.

"I also claim as new, the construction or arrangement of a holder composed of two parts with springs between the two parts pressing them from within outwards against the bent edges or corners of the daguerreotype plate, and secured from contraction by a button or wedge substantially as in the drawing. And in combination with such a holder, I claim the bending of the edges or corners of the plate so as to secure the same to this holder.

"I also claim the adaptation of a daguerreotype plate with its edges or corners bent as shown in the drawings to a movable holder constructed substantially as described."

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99. For an *Improvement in Apparatus for Splitting and Stretching Leather;* Bradford Rowe, Albany, New York, April 30.

Claim.—"I claim the construction of a machine for performing the business of rolling, splitting, and stretching leather, at one operation as set forth, viz:—The following combination of machinery; one roller driven by the motive power, having another roller moving above it between which two rollers the leather is to be compressed, the upper roller running free upon its own axis, which is fixed in a vibratory frame in order that said upper roller may be adjusted thereby to any variable or determinate pressure upon the leather by proper power applied to said frame; a second roller placed a short distance in front of and parallel with the first named one running free on its own axis; a smaller roller (placed in a second vibratory frame similar to and adjustable like the first mentioned frame), running above the last mentioned roller to perform the functions of compressing the leather, and holding it firmly to receive the cut of the knife. A knife supported by strong springs and placed just in front of the last mentioned pair of rollers, with its cutting edge a short distance from the point of compression of these rollers so as to act upon the leather directly as it leaves the rollers.

"A movable frame to carry the leather to be operated or moved by a gearing connecting it with the first roller, and giving it a certain proportional rate of movement compared with that of the roller, by which the quantity of stretch to be imparted to the leather can be regulated. An apparatus for gauging the knife to cut the leather to a given thickness, consisting of a pair of eccentrics on the ends of a shaft running parallel with the knife, and operating upon each end of it equally as the said shaft is turned round, with an index plate and set lever to regulate and fix the same during the operation of the machine."

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100. For an *Improvement in Vats or Press Boxes for Cheese;* Augustus N. Severance, Cherry Valley, Ashtabula county, Ohio, April 30.

Claim.—"What I claim as my invention, is providing cheese vats with a movable joint which is operated by a crank or lever to enlarge and diminish the size of the vat, substantially in the manner and for the purposes set forth."

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101. For an *Improvement in Roasting Coffee;* W. H. Trisler and Elias Brecht, Fairview, Erie county, Pennsylvania, April 30.

Claim.—"What we claim as our invention, is the application of steam or vapor to the grains of coffee just previous to subjecting them to the action of a dry roasting heat, within an apparatus constructed and operated substantially in the manner herein set forth."

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102. For a *Machine for Making Wrought Iron Railroad Chairs;* William Van Anden, Poughkeepsie, New York, April 30.

Claim.—"What I claim as my invention, is, 1st, the double or parting die, substantially as described, parting by means of a joint at the top or otherwise, for the purpose set forth.

"2d, The vertical shears and benders working in connexion with the double die in such a manner as to cut and form the lips of a chair at one operation, substantially as described.

"3d, I also claim the combination of dies, shears, punches, benders, and clearers, arranged and operated in the manner and for the purpose above set forth, or any similar arrangement wherein the combination is essentially the same."

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103. For an *Improvement in Board and Log Rules;* Benjamin M. Vanderveer, Clyde, Wayne county, New York, April 30.

The patentee says,—"The nature of my invention consists in a novel, compact, and convenient combination of the ordinary log tables now in use (in a book form), for ascertaining the number of feet of square edged inch thick boards a log of given length and diameter will make, with the common board rule or measure, so as to give at a glance the contents of these tables with perfect accuracy and without further recourse."

Claim.—"What I claim as my invention, is the combination of the log table and board rule in the way and manner and in the form described."

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104. For *Pipe Coupling;* Chapman Warner, Louisville, Kentucky, April 30.

The patentee says,—"The nature of my invention consists in enveloping the abutting ends of two pipes with a belt of some soft substance, and forcing over it a sleeve of some harder substance."

Claim.—"What I claim as my invention, is fastening together the abutting ends of two pipes, by forcing a sleeve of some hard substance over a belt of some softer substance which envelopes the seam and is thus compressed between the sleeve and the pipes."

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105. For an *Improvement in the Rubbers of Smut Machines;* Franklin Wright, Indianapolis, Indiana, April 30.

The patentee says,—"The nature of my invention consists in constructing the machine with a vibrating concave rubber, which operates in connexion with a feeding and rubbing cylinder; the cylinder forming the bed against which the rubber rolls the grains, and thereby pulverizes and detaches the smut. This machine is also adapted to hull rice and act usefully on similar articles."

Claim.—"What I claim as new, is the vibrating rubber, in combination with the feeding and rubbing cylinder, constructed and operated substantially in the manner and for the purpose described."

106. For a *Method of Preventing Accidental Discharge in the Prussian Gun;* J. Wurfflein, Philadelphia, Pennsylvania, April 30.

The patentee says,—"My improvement consists in a cap over the openings formed in the breech, and in the security guard to prevent the piece from being discharged when the parts are not in the proper position, and in the form and adaptation of the piston, which serves as a breech pin and to ram home the charge."

Claim.—"What I claim as new, is the guard to prevent the discharge of the arm when all the parts are not in proper position, constructed, combined, and arranged with the arm, and operated substantially in the manner and for the purpose set forth."

Re-issue for April, 1850.

1. For an *Improvement in Cooking Stoves;* Jordan L. Mott, City of New York; patented August 22, 1848, re-issued April 30, 1850.

Claim.—"What I claim as my own invention, is, 1st, making the back of the oven of a series of vertical flue tubes, in combination with the flue tubes in the bottom, substantially as herein described, to equalize the heat of the oven.

"2d, I claim lining the inside surface of the bottom plate of the stove with some refractory earthy cement or polished surface, as described, in combination with the series of flue tubes constituting the back and bottom of the oven, for the purpose and in the manner described.

"3d, I claim making the front part of the top plate separate from, and attached to, the top plate by bolts or otherwise, substantially as described, when combined with the sunken connecting piece, whereby the cracking consequent upon over-heating, and unequal expansion and contraction of that part which is exposed to a high temperature, is prevented.

"4th, I claim the combination of a fire-box, made with a grate or openings for draft in the bottom thereof, substantially as described, with the coal feeder, having an aperture or apertures for draft between it and the upper edge of the fire pot, substantially in the manner and for the purpose described.

"I do finally claim, in combination with a grate, a series of eccentric plates, or cam-formed plates of equivalent form, arranged on a shaft so located relatively to the grate bars as, by the vibration of the shaft in either direction, the said plates shall play between the grate bars, and separate and clear out cinder, slag, and other hard substances, substantially as described."

Additional Improvement for April, 1850.

1. For an *Improvement in Separating Stearine from Elaine;* John H. Smith, Brooklyn, New York; patented April 1, 1842, additional improvement annexed April 9, 1850.

The patentee says,—"The nature of my additional improvements consists in mixing sufficient alcohol to the pulverized stearic acid till it becomes quite moist, then submitting it to hydraulic pressure."

Claim.—"What I claim as my additional improvements, is the application of alcohol, as herein described, for the purpose of making candles."

Designs for April, 1850.

1. For a *Design for Stoves;* James Wager, Troy, New York, April 2.

Claim.—The described combination of mouldings and illustrated ornamental figures for six-plate stoves."

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2. For a *Design for Stoves;* David L. Bartlett, Baltimore, Maryland, April 9.

Claim.—The described and illustrated design for stoves.

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3. For a *Design for Stoves;* A. Cox & Co., assignees of Joshua Crandall, Troy, New York, April 9.

Claim.—The design and configuration of the ornaments, so disposed on the doors, feet, and other parts of the stove, constituting, in combination, a new design of stove, substantially the same as described and represented.

4. For a *Design for Cooking Stoves;* Jeremiah D. Green and George Warren, Troy, New York, April 16.

Claim.—The design and configuration of ornaments in the panels of the doors and on the feet, so as to constitute in combination a new design of cooking stove, as described and represented.

5. For a *Design for Stoves;* P. A. Palmer, Le Roy, Genessee county, New York, April 30.

Claim.—The design of ornament and configuration constituting in combination a new design of stove, substantially the same as described, and represented in the drawings.

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Salinometers for Marine Boilers.

The salinometer is, as its name imports, an instrument for testing the density or degree of saturation of salt water; its use in steamers being to prevent the water in the boilers from becoming too dense, and thereby occasioning deposits on the interior of the shell, &c.

It is well known that if sea water containing a certain proportion of salt ($\frac{1}{33}$ of its weight) be heated within a boiler, the water only being converted into steam, a continually increasing density of the remainder must be the result.

Now experience has shown that when this saturation reaches a certain limit, an incrustation or deposit on the boiler takes place which forms rapidly, and if carried to any extent prevents the heat given off by the flame from being transmitted with sufficient rapidity,—thus increasing the consumption of fuel and burning out the iron. To prevent this, the expedient has been successfully resorted to of withdrawing from the boiler a certain definite proportion of the water thrown in, which quantity depends on the degree of saturation which it is desired to maintain.

The means employed for making this discharge may be generally divided into "blow cocks," "brine valves," and "brine pumps;" the first acting by the direct action of the steam upon the water, when opened by the attendant or otherwise. Brine valves are discharge valves attached to the stem of the "check" or feed valves on the boilers, and of proportionate diameter, so that every stroke of the feed pump ensures a corresponding lift of the valve. Brine pumps are worked by the engine, and of capacity similarly proportioned to that of the feed pump, (usually made $\frac{1}{3}$ to $\frac{1}{4}$.)

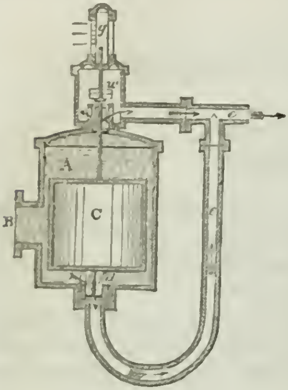
It is evident that the engineer should be provided with some means of judging of the saturation in his boilers, in order to regulate these various contrivances: in other words, that he must have means of testing density by a salinometer.

This was formerly, and is still, done by withdrawing from the boiler in a cup a sufficient quantity of water, and immersing therein an ordinary hydrometer. But the inconvenience of this method, and consequent liability to neglect, has occasioned the introduction of more refined means to accomplish the same end.

Sometimes hollow glass balls, of such weight and bulk as to float at the required point, are enclosed in vertical glass tubes communicating with the boilers,—showing by their depth of immersion the point of saturation. In another plan, copper floats are placed within the boiler, attached to a valve placed in the discharge pipe, opening it when they rise from the increased density.

Of a somewhat similar form is the instrument recently patented in England, known as "Mather's Salinometer and Marine Blow-off," given in the accompanying cut, fig. 1, which is the best of *its class* we have seen. It consists of a separate vessel A, bolted on and opening into the boiler at B, below the water level, enclosing a hollow brass float C having a centre vertical spindle; upon this spindle, above and below the float, are two pistons sliding in cylinders, *d d*, connecting with the blow-off pipe *e e*, and so fixed that when, by the increasing density of the water, the float rises, they reveal openings in the sides of the cylinders through which the water may escape. The pistons being of equal diameter, there is no tendency to open or close them. Means of adjustment are provided, in the form of small weights *w* placed upon the upper part of the spindle, which, continuing through the piston, rises high enough to be seen in a close glass tube *g* surmounting the chest, and thereby serves as an index to show the action of the instrument.

Fig. 1.



Without stopping to consider the liability of this instrument to become choked, nor the necessity of constant and delicate adjustment, varying with the pressure at which steam is maintained, both which would probably operate against it, we must be allowed to say a few words respecting another and more important objection. We allude to the independent or self-acting nature of the apparatus, which, however ingenious in design or satisfactory in performance *for a time*, ought still, from prudential motives, to banish it from steam boilers, when the slightest failure in the feed or blow-off gear, if unobserved by the engineer, would be productive of the most disastrous consequences. The confessed object of all such arrangements is to transfer from the engineer a portion of that responsibility which should properly attach to him, and their result to beget a feeling of confidence which leads to entire neglect. This is the legitimate and inevitable consequence; if it be not produced it is because the engineer is careful enough to bestow upon his boilers that attention which would be paid to the ordinary attachments. *Experience at sea* always leads the engineer to prefer the "old-fashioned" blow cock to all its modern substitutes.

But to return to our subject; we have only space to describe one other form of salinometer, which will probably be found the most efficient instrument yet produced, from its convenience, little liability to clog, and the possibility of placing it in any desired position. This is the invention of Wm. Sewall, Jr., U. S. N., and is patented and known in England under the name of "How's Salinometer." There is no novelty in the *principle* involved, (the hydrometer being employed,) but its claims to the above important advantages will be recognized from a short description.

It consists of a cylindrical brass chamber A, (figs. 2 and 3,) permanently attached in a vertical position, having on its side near the bottom two cocks *c'' d''*, with pipes *c' d'* leading into the boiler, the one directly over the furnace crown, the other near the bottom of one of the "legs." Either may be used as desired, but the former (*c'*) is that generally employed. An outlet pipe leads from the bottom of the chamber, furnished with a cock *f*, below which enters another pipe *e*, whose mouth or upper end is about half an inch below the top of the chamber; this forms an overflow. A Fahrenheit thermometer *i*, attached securely to the inner side of the chamber, and a hydrometer *g*, graduated for saline solutions containing from $\frac{1}{33}$ to $\frac{12}{33}$, (the latter being the point of saturation,) sliding freely in a guide *h* for steadiness, complete the apparatus.

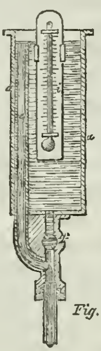


Fig. 2.

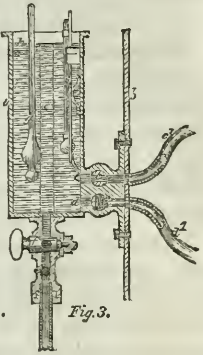


Fig. 3.

When in use, the cock *c'* to the boiler is always partly open, while the overflow *e* carries off the water as rapidly as it enters; but when it is desired to test the density this cock is shut until the water has cooled to 200° Fahr., when the hydrometer is read off and the current re-established, thus preventing saline deposits in the pipes. This instrument has been thoroughly tried at sea, and has, we believe, given full satisfaction.

M.

Experiments and Observations upon the Properties of Light. By LORD BROUGHAM.*

The author states that the optical inquiries of which he here gives an account were conducted in the first instance under the most favorable circumstances, arising from the climate of Provence, where they were commenced, being peculiarly adapted to such studies; he further states that he subsequently had the great benefit of a most excellent set of instruments made by M. Soleil, of Paris; remarking, however, that this delicate apparatus is only required for experiments of a kind to depend upon nice measurements, and that all the principles which he has to note in this paper as the result of his experiments can be made with the most simple apparatus, and without any difficulty or expense. His statement of the results of his experiments is thrown into the form of definitions and propositions, for the purpose of making it shorter and more distinct, and of subjecting his doctrines to a fuller scrutiny. He premises that he purposely avoids all arguments and suggestions upon the two rival theories, the Newtonian or Atomic, and the undulatory. The following are the author's definitions and propositions:—

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* From the London Athenæum, for January, 1850.

Definitions:—1. *Flexion* is the bending of the rays of light out of their course in passing near bodies. 2. Flexion is of two kinds—*inflexion*, or the bending towards the body; *deflexion*, or the bending from the body. 3. *Flexibility*, *deflexibility*, *inflexibility*, express the disposition of the homogeneous or color-making rays to be bent, deflected, or inflected by bodies near which they pass.

Proposition 1.—The flexion of any pencil or beam, whether of white or of homogeneous light, is in some constant proportion to the breadth of the colored fringes formed by the rays after passing by the bending body. Those fringes are not three, but a very great number, continually decreasing as they recede from the bending body, in deflexion, where only one bending body is acting; and they are real images of the luminous body by whose light they are formed.

Prop. 2.—The rays of light, when inflected by bodies near which they pass, are thrown into a condition or state which disposes them to be on one side more easily deflected than they were before the first flexion; and disposes them on the other side to be less easily deflected; and when deflected by bodies they are thrown into a condition or state which disposes them to be more easily inflected, and on the other side to be less easily inflected than they were before the first flexion.

Prop. 3.—The disposition communicated to the rays by the flexion is alternative; and after inflexion they cannot be again inflected on either side; nor after deflexion can they be deflected. But they may be deflected after inflexion, and inflected after deflexion, by acting on the sides disposed, and not by acting upon the sides polarized.

Prop. 4.—The disposition impressed upon the rays, whether to be easily deflected or easily inflected, is strongest nearest the first bending body, and decreases as the distance increases.

Prop. 5.—The fringes made by the second body acting upon the rays deflected by the first, must, according to the calculus applied to the case, be broader than those made by the second body deflecting those rays inflected by the first.

Prop. 6.—When one body only acts upon the rays, it must, by deflexion, form them into fringes or images decreasing as the distance from the bending body increases. But when the rays deflected and disposed by one body are afterwards inflected by a second body, the fringes will increase as they recede from the direct rays. Also, when the fringes made by the inflexion of one body, and which increase with the distance from the direct rays, are deflected by a second body, the effect of the disposition and of the distances is such as to correct the effect of the first flexion, and the fringes by deflexion of the second body are made to decrease as they recede from the direct rays.

Prop. 7.—It is proved by experiment that the inflexion of the second body makes broader fringes or images than its deflexion, after the deflexion and inflexion of the first body respectively; and also that the deflexion fringes decrease, and the inflexion fringes increase with the distance from the direct rays.

Prop. 8.—The joint action of two bodies situated similarly with respect to the rays which pass between them so near as to be affected by both bodies, must, whatever be the law of their action, provided it be inversely as some power of the distance, produce fringes or images which increase with the distance from the direct rays.

Prop. 9.—It is proved by experiment that the fringes or images increase as the distance increases from the direct rays.

These propositions are illustrated by particular instances, and their truth is shown by experiments and by some mathematical investigations. The author concludes his paper by a few observations tending further to illustrate and confirm the foregoing propositions, and for the purpose of removing one or two difficulties which had occurred to others until they were met by facts, and also of showing the tendency of the results at which he had arrived.—*Proc. Roy. Soc., Jan.* 10, 1850.

Translated for the Journal of the Franklin Institute.

Examinations of the Velocity of Propagation of Electricity. By MM. H. FIZEAU and E. GOUNELLE.

The authors have hit upon what appears to be an entirely different method for the delicate determination of which they were in search. After referring to the method of Professor Wheatstone and Mr. Walker, they proceed as follows: "The researches which form the subject of this memoir were made by a method different from the two preceding ones. The principle upon which it rests consists in interrupting a current at intervals of time rapidly succeeding each other, and at two points very far apart, of a conductor; and in observing upon a galvanometer the deviations produced, which vary with the number of the interruptions, and becomes a maximum for a certain number of interruptions, and a minimum for another."

"These experiments were made upon the wires of the Electric Telegraph from Paris to Rouen, and from Paris to Amiens, which were at several different times placed at our disposal by the great kindness of M. Lemaître and M. Foy, successively chief managers of the telegraphic lines.. The two wires of each of these lines could be united at Rouen and Amiens, and thus present conductors of great length, the extremities of which terminated in the same room of the office of the Minister of the Interior. We had thus on the Amiens line a length of 314 kilometres, (195 miles,) on that of Rouen 288 kilometres (179 miles.) The first is constructed of iron wire, the second of iron wire for about one-third of its length, and for the other two-thirds of copper wire. This circumstance was very fortunate for our researches, since it allowed us to perceive that the velocity is not the same in the two conductors. The interruptions were produced in the following way: a wooden wheel of 50 millimetres (2 inches) (*in diameter?*) carried upon its circumference thirty-six equal divisions, eighteen of platina and eighteen of wood, alternately with each other. This wheel was mounted upon the axis of a rotary machine of M. Froment, in which a counter permits the velocity to be measured. Platina plates disposed in pairs, and insulated from each other rested upon the divisions, each pair thus forming a distinct interrupter. They may all be so regulated as to procure concordant or alternate interruptions. The experiment was arranged in several ways; the best arrangement consists in the employment of a differential or double wired galvanometer, and three interrupters, A B and C. These last being so arranged that A alternates with B, and accords with C."

"Let a pile be in communication with the earth by one of its poles, by the other with A, then with one of the telegraph wires; the two wires being united at the other extremity of the line, the current returns by the other wire; this latter is put into communication with B and C, each of these latter with one of the wires of the galvanometer, finally, each of these wires with the earth. The current may thus reach the earth by two ways which are alternately opened and closed; and, according as the passage takes place by the one or other, the needle of the galvanometer is deviated in opposite directions. During the rotation of the wheel only discontinuous currents pass through the galvanometer; but it is known by the experiments of M. Pouillet, that when the interruptions succeed each other rapidly, the needle is deviated in a stable manner as if the current was continuous. In this arrangement the velocity of propagation is shown by the periodical changes in the deviations, corresponding to increased velocities of rotation, but the periods are not all alike; the second is less marked than the first; the third is scarcely sensible. For the Amiens line, the first period took place with a velocity of 9 turns per second; for the Rouen line, with the velocity of 13·58 turns."

"The experiments which we have made by this method lead to the following results:—

"1st, In an iron wire of 4 millimetres (0·16 in.) diameter electricity is propagated with a velocity of 101,710 kilimetres per second, say 100,000 kilometres (62,159 miles.)

"2d, In a copper wire of a diameter of 2·5 millimetres (0·1 in.) this velocity is 177,722 kilometres, say 180,000 kilometres (111,886 miles.)

"3d, The two electricities are propagated with the same velocity.

"4th, The number and nature of the elements of which the pile is formed, and consequently the tension of the electricity and the intensity of the current, have no influence upon the velocity of propagation.

"5th, In conductors of different natures, the velocities are not proportional to the electric conducting powers.

"6th, When the discontinuous currents are propagated in a conductor, they experience a diffusion, in consequence of which they occupy a greater space at its point of arrival than at its point of departure.

"7th, The velocity of propagation appears not to vary with the section of the conductors; our experiments lead us to consider this principle as very probable.

"8th, If this principle is true, the velocity of propagation changes only with the nature of the conductor, and the numbers which we give represent the absolute velocities in iron and copper."—*Comptes Rendus de l'Acad. des Sciences de Paris*, *tom.* XXX. *p.* 437.

We cannot say that we completely understand the plan thus rapidly described in the *Comptes Rendus*, and we shall anxiously wait for further developments when the memoir is published at length. The tabulated experiments will also be of great interest. In the meantime, we may safely confine ourselves to the expression of the opinion, that the method of

MM. Fizeau and Gounelle is less advantageous for this purpose than those used by Wheatstone and Walker; and that their deduction that the intensity of the current has no influence upon the velocity of propagation is in contradiction with the results of former experiments.—Ed.

For the Journal of the Franklin Institute.

Description of Simpson's Hydro-Pneumatic Lift for Furnaces and Railway Elevators. Condensed from the Practical Mechanic's Journal, Glasgow, for March, 1850.

In this apparatus the principle on which the lift is effected is that known as *Flotation.* An air-tight sheet metal case, of sufficient displacement for the greatest weight which it is designed to raise, being immersed in a well containing water, and attached by means of a large vertical pipe of the same material to an upper platform rising between guides; when the case is released, it will of course ascend, carrying upon its platform the articles to be raised. The valve apparatus for governing the motions, etc., constitutes the novelty of the machine, and is worthy of notice. The "float case" is made spheroidal, and is connected as has been described, to the platform by a hollow pipe, closed above by the platform, and below perforated, so that in the movement of the machine, its bulk shall not materially affect by a greater or less degree of immersion the usual level of water in the well. The float case itself is provided with a small pipe rising in the centre of the large one, which opens to the air above by means of a governing valve, and also serves to protect a valve rod connecting the operator on the platform, with a small screw valve in the bottom of the float case, designed for the ingress and egress of water. The large hollow pipe is also provided with a small valve above for governing the outlet of air.

An induction pipe enters at the top of the well, and is *always open.* A discharge pipe at the bottom is provided with a valve, opening outward, whose lever is weighted so as to counterbalance the pressure of water tending to open it.

The operation of the machine is as follows:—

Let us suppose the float case full of air, and at the bottom of the well which is empty; all the valves shut. If then water be allowed to fill the well, the buoyancy of the float causes it to ascend, carrying upon its platform the goods to be elevated. When it is desired to descend, open the screw valve in the float case, and its governing air valve, until a sufficient body of water has entered to destroy buoyancy, when, the air valve to the large pipe being also open, the machine will descend with any desired velocity. On approaching the bottom, the open screw valve comes in contact with the weighted lever governing the discharge, and has just had time to open it, when the float *subsides* into the bottom of the well, made of exactly the same shape as that of the float, thus opening a passage between the *float case* and the discharge pipe, permitting water to escape until its buoyancy is sufficiently restored for a reascent. As the float case exactly fits in the bottom of the well, (the *fit* being secured by packing,) no water is permitted to escape from the well itself.

It will thus be seen that the machine possesses two advantages over the usual plans of flotation.

1st, That only the exact amount of water required to balance the load and to overcome friction is expended for each lift. And 2dly, that the well being always full, no time is lost in filling and emptying it. M.

On some Deoxidizing Effects of Carbon. By Prof. Schönbein.[*]

1. When ordinary charcoal powder is agitated, even but for a few minutes, with an aqueous solution of perfectly pure perchloride of iron, the latter, when filtered, strikes a deep blue color with ferridcyanide of potassium, showing that under the above circumstances protochloride of iron is formed. When a definite quantity of the solution of the perchloride is treated long enough, and with a sufficient quantity of charcoal powder, the whole of the perchloride is converted to protochloride. This change is effected the more quickly the finer the charcoal is powdered, on which account calcined lamp-black is far more effective than ordinary charcoal powder. It deserves to be mentioned that even pulverized coke produces a similar effect upon the salt of iron.

2. The sulphate, nitrate and acetate of the peroxide of iron, dissolved in water, are completely converted into protosalts by agitation with charcoal powder; whence we are led to conclude, that all persalts of iron, dissolved in water or in any other menstruum, may be converted by carbon, even without the assistance of heat, into protosalts.

With respect to the behavior of carbon towards a solution of the pernitrate of iron, the following statements may be mentioned. If the solution is so dilute that it appears of a light yellowish-brown color, and it is shaken for a few minutes with charcoal powder, the filtered liquid is of a much darker color than the original solution. After further brief treatment with fresh charcoal, the color of the solution becomes much darker; and after a third or fourth operation of the same kind, the liquid appears almost colorless, in which case it now contains no longer a trace of the persalt of iron, but only protosalt. This darkening of the color arises from the charcoal removing not only oxygen from the solution of the persalt of iron, but some nitric acid at the same time; which gives rise to the formation of basic pernitrate of iron, the cause of the dark color.

3. When the solution of the ferridcyanide of potassium is shaken only for a few minutes with ordinary charcoal powder, the filtered liquid strikes a pretty deep blue color with perchloride of iron, or the solution of any other persalt free from protoxide. The same solution, agitated for a sufficient time and with a sufficient quantity of charcoal powder, is so changed, that it furnishes a copious dark blue precipitate with a solution of a persalt of iron, or leaves on evaporation a yellowish residue, which I have not yet been able to examine more closely, but which appears to consist for the greater part of ferrocyanide of potassium.

Regarding the dissolved ferridcyanide of potassium as a double salt, consisting of prussiate of potash and prussiate of the peroxide of iron, and the dissolved ferrocyanide of potassium as prussiate of protoxide of iron and potash, the above effect of the carbon might be explained from a conversion of the per- into the protoxide of iron.

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[*] From the London Chemical Gazette.

4. A solution of the perchloride of mercury, agitated sufficiently long with a suitable quantity of charcoal powder, is rendered tasteless and incapable of furnishing peroxide of mercury with solution of potash. The perchloride is converted under these circumstances into protochloride.

5. A dilute solution of pernitrate of mercury, perfectly free from protoxide, shaken but for a few minutes with charcoal powder, and then filtered, is rendered very turbid by muriatic acid or a solution of chloride of sodium arising from precipitated protochloride of mercury, which proves that the charcoal converts a portion of the pernitrate of mercury immediately into protosalt even in the cold. By shaking the same solution of pernitrate three or four times in quick succession with fresh portions of charcoal powder, I succeeded in obtaining, in the course of a quarter of an hour, a protosalt perfectly free from peroxide. This property of carbon may be usefully employed in freeing soluble protosalts of mercury from any admixture of persalt.—Poggendorff's *Annalen*, LXXVIII. *p.* 521.

Improvements in Iron Manufacture.[*]

Sir F. C. Knowles has recently patented an improved method of making iron direct from the ore, which appears to be based on sound chemical principles. The patentee states that the method was suggested to him by a consideration of the fact that coal, in the process of coking, whether in coke ovens, or in the blast furnace, as raw coals, loses a large portion of its weight in the form of gaseous matter, composed chiefly of carbon and hydrogen, and by considering the well-known superior deoxidizing and cementing power of these elements in the aeriform state, as compared with their solid and crude condition in coke or bituminous coal. This loss is increased by the action of the blast on the materials in the lower parts of the blast furnace, which has been computed at upwards of eighty per cent. of the entire weight where raw coal is used. In addition to this, only the poor earthy ores have been used, while the nearly pure ores have been neglected; and we import foreign iron for the purpose of conversion into steel.

For the first process—that of making the iron direct from the ore, without any previous smelting—the patentee selects those ores most free from earthy matter, and the nearer they approach to pure oxides the better. For another process—the preparing ores by cementation in retorts, to make cast-iron, by smelting afterwards—the ores are taken indifferently, excepting such as contain much sulphur and arsenic. They are first broken into pieces of moderate size, so as, when placed together in a heap, there may be interstices between them capable of admitting a gas, or vapor, through them without obstruction. They are then placed in retorts, rendered gas-tight, and brought up to a red heat, each of which is connected with gas-tubes, having stop-cocks for the purpose of injecting and regulating a current of gas among the ore. For this purpose two sorts of gases are used by the patentee--common carburetted hydrogen, or coal gas, and carbonic oxide, prepared by slow combustion of charcoal or coke. The patentee does not confine himself to coal gas, but employs any hydro-carbon which can be produced economically. When the retorts are charged, and the gas generated, the *rationale* of the process will be as follows:—The ore being mainly an oxide of iron, the hydrogen of the hydro-carbon unites with the oxygen of the ore to form water, while the carbon unites with another portion of oxygen, forming carbonic oxide or carbonic acid, as the case may be, leaving metallic iron as the result. The ore being so far reduced, the next stage of the process, when malleable iron is the proposed product, is to shut off the gas on both sides of the retorts, and transfer the contents of the retorts to the puddling furnace, where the iron is treated in the common way. It may be cut, piled, reheated, and rolled as usual, according to the nature of its distinction or quality required. If steel be required, the cementation must be carried further, until the reduced metal has absorbed about 1 per cent. of carbon. The reduced and cemented ore is then put into crucibles, or melting pots, to be run down into ingots in wind-furnaces, as is now done in the making of cast steel. If the earthy matter in the ore require it, some proper flux is to be added; according to the usual method of fluxing iron ores. If cast iron be required, the cementation must be carried on until about 3 or 4 per cent. of carbon is absorbed, after which it is transferred to the blast furnace, with a proper flux. The patentee further claims, where cast iron or steel is the product required, the separate cementation of iron ores with charcoal, coke dust, anthracite coal, coke, &c., on the following iron ores:—Pure specular ore, red and brown hematite, black oxide, red and brown ochreous ores, magnetic iron ores, spathose ores, being carbonates of protoxide of iron, and different from the argillaceous iron ores of the carboniferous series of rocks above the mountain limestone. Lastly, the patentee claims the use of spathose iron ores and "soft mine" as a flux, to supersede the use of limestone; the ore is first roasted, to drive out the carbonic acid, and then mixed with other ores in such proportion that the lime contained in the aggregate may bear a due proportion to the silica and alumina in the other iron ores to be smelted.

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[*] From the London Artizan, for February, 1850.

Translated for the Journal of the Franklin Institute.

Construction of the Bunsen (Carbon) Battery.

M. Deleuil suggests *(Comptes Rendus de l'Acad. des Sciences de Paris, 15th April,* 1850,*)* a modification in the construction of the Bunsen (carbon) battery which is simple and important. The modification consists in replacing the metal collars which rapidly corrode and oxidize, by glass collars, which resist the corrosive action of acids, and thus will ensure almost indefinite duration to these instruments. It may be remarked that these glass collars can support a pressure from within, outwards; that is, upon the wedge in contact with the carbon of 240 lbs.

Description of Improvements in Traps to be applied to Closets, Drains, Sewers, and Cesspools. Patented Sept. 30, 1849, *by* Chas. Marsden, *of the Kingsland Road, Middlesex.*[*]

Fig. 1 is a vertical section of a trap for a street sewer, constructed according to this invention; fig. 2 is a back elevation of the same; and fig. 3 an under view of the apparatus, with part (E) removed. A A is the external grating; B B the brickwork of the gully leading to the sewer; C a hood of the peculiar form represented; D a broad rim or flanch, by which the hood rests upon, and is suspended from, the brickwork, this flanch being made air-tight all round by cement. E is a drum or wheel, which turns upon two pivots F F within the under half of the hood C; H H are two partition plates by which the drum is divided into four equal compartments, having no communication interiorly with each other, forming thus, in effect, four separate receivers or buckets. I I I I, flaps of vulcanized India rubber, or any other suitable flexible substance, which overhang the four compartments of the drum, these flaps being secured by rivets or screws at their upper ends to ledges *b b*, projecting from the inner surface of the lower half of the hood, but left loose at their lower ends; and K K (see fig. 3) are two more flaps of vulcanized India rubber, which press sideways upon the flaps I I I I, and close up the ends of the drum.

Fig. 1.

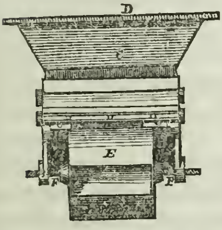


Fig. 2.

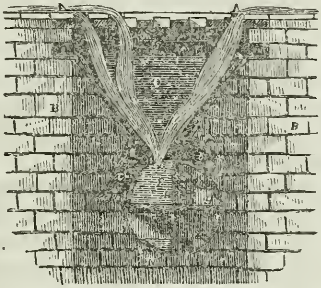
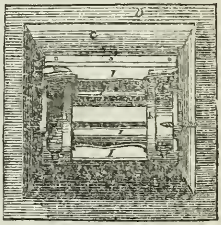


Fig. 3.



The street drainage, falling through the grating, passes first into the upper half of the hood, from which it descends into one of the compartments or buckets, (whichever happens to be uppermost at the time,) and as soon as that bucket becomes filled it tilts over of its own weight, and empties itself into the drain M, while another bucket ascends from the opposite side to take its place. One of the buckets is thus always being filled, a second in the course of emptying itself, and the two others on their ascent to be filled and emptied in their turn, while any upward escape of effluvia during these successive changes is effectually prevented by the overhanging flaps I I I I, and end flaps K K.

Claims.—1. The construction of traps for closets, drains, sewers, and cesspools, of a drum or series of buckets, caused to revolve by the weight of the matters falling into the same, and made air-tight by overhanging and side flaps of vulcanized caoutchouc, or other suitable substance.

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[*] From the London Mechanics' Magazine, for March and April, 1850.

2. The forming of the discharge aperture of the closet-pan of an oblong form rounded at the ends, or of an oval form.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, June 20th, 1850.

Samuel V. Merrick, President, in the chair.

Solomon Roberts, Corresponding Secretary.

Isaac B. Garrigues, Recording Secretary.

John F. Frazer, Treasurer.

The minutes of the last meeting were read and approved.

Letters were read from The Royal Society, London, and from the Mercantile Library Association of St. Louis, Mo.

Donations were received from The Royal Irish Academy, Dublin; Hon. Joseph R. Chandler, U. S. Congress; Prof. A. D. Bache, Coast Survey, Washington City, D. C.; Prof. John F. Frazer, George W. Smith, Esq., Dr. Isaac Hays, Prof. James C. Booth, S. W. Roberts, Esq., and Charles E. Smith, Esq., Philadelphia; Mercantile Library Association, St. Louis, Mo.; F. C. Lowthrop, Esq.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Board of Managers and the Standing Committees reported their minutes.

The Treasurer read his statement of receipts and payments for the month of May.

The Special Committee on the School of Design for Women presented the following report and resolutions, which were adopted:

The Committee appointed to examine and report upon the mode in which the Franklin Institute can best forward the project of a School of Design for Women, Report,—

That, after frequent consultations with Mrs. Peter, the originator of the project for a School of Design for Women, they have come to the following conclusions:

1st, That the establishment of such a school would be of great advantage to the community, in a two-fold manner; first, by opening a new and lucrative field for the employment of female industry, and secondly, by improving our manufactures by giving to them that originality of design in which they are now deficient.

2d, That the position which the Franklin Institute holds in regard to the industrial arts of our city, and the confidence which is placed in it by the community, render it in the highest degree desirable that an institution of this kind should be established under its auspices, and conducted under its supervision; but that the pecuniary condition of the Institute renders it highly inexpedient, if not absolutely impossible, that the funds of the institution should be used for the establishment of this school.

Under these views, and believing that with proper exertions a sufficient sum to ensure the efficiency of the school can be raised from the liberality of our community, the Committee recommend to the Franklin Institute the adoption of the following plan for the establishment of a School of Design for Young Women.

On behalf of the Committee,

S. V. Merrick, *Chairman.*

Resolved, That a school shall be and hereby is established by "The Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts," for the instruction of women in the arts of design and in the various practical applications thereof, and that said school shall be opened and conducted under the following rules:

1st, Subscriptions shall be received for the endowment and support of the school, of sums of money, to be invested and the interest received thereon to be applied to the current expenses, and of other sums which the subscribers may agree to contribute annually for its support. All subscriptions shall be paid to the Treasurer of the Franklin Institute, and such of them as are to form the permanent endowment shall be invested in the name of the Institute, and be held by it in trust for the school subject to the direction of the Committee hereafter to be provided for.

2d, As soon as the fund subscribed for the endowment of the school and the annual subscriptions shall produce an income of two thousand dollars per annum, the school shall be opened in a suitable apartment to be rented for that purpose, and supplied with such fixtures and furniture and other articles as may be needed for the accommodation and instruction of the pupils.

3d, The management and control of the school shall be confided to a Committee to consist of three gentlemen and three ladies, who shall be appointed by the Board of Managers of the Institute forthwith, and annually hereafter at their stated meeting in July, or at the first stated meeting thereafter at which there shall be a quorum. Said Committee shall have power to appoint and dismiss the instructors and other assistants and servants for the school, and to fix their compensation and duties; to fix the number, kind and duration of the courses of instruction, and to admit and discharge pupils either gratuitously or upon the payment of a tuition fee. But they shall have no power to contract any debt or engagement exceeding the amount of the annual income of the school, and all money for tuition fees shall be paid to the Treasurer of the Institute and be applied to the purposes of the school under the direction of the Committee.

They shall meet monthly at such time and place as they may designate, elect a Chairman and Secretary, keep regular minutes of their proceedings, and lay the same monthly before the Institute at its stated meetings.

They shall make annually a detailed report of the progress and condition of the school, the various branches taught therein, the number of the pupils, the annual expenses and amount and investments of the permanent endowment, and the amount of the annual subscriptions.

The bills and claims against the school shall be certified monthly to the Board of Managers of the Institute, and shall be paid by orders drawn upon its Treasurer, which payment shall be charged by him to the account of the school.

The ladies of said Committee shall be specially charged with the examination of the moral character and circumstances of the applicants for admission as pupils. And from their report the general Committee shall, at their stated monthly meetings, or oftener if found necessary, admit scholars.

The ladies of said Committee shall also be the stated visitors of the School, and under such rules as may be adopted by the general Committee for that purpose superintend its discipline and order. But any male member of the Committee shall be authorized at all times to visit the school, and to report at the stated meetings of the Committee any matter which in his judgment may need correction.

4th, The pupils of the school shall have the privilege of attending the lectures and exhibitions of the Institute, and of visiting and inspecting the cabinets of models, minerals, and specimens of the arts and manufactures. They shall also be permitted the use of the library on complying with such rules as may be adopted for securing the safe and punctual return of the books loaned to them.

5th, Should the funds provided for the support of the school at any time be found inadequate to defray its current expenses, it shall be the duty of the Committee forthwith to suspend it. And all contracts or engagements made by them in its behalf, shall contain provisions giving such right of suspension to the Committee without claim on the part of the instructors, assistants, and servants, whose functions may be terminated by such suspension for any pay or compensation thereafter.

And in case such suspension shall at any time be found necessary, it shall be immediately reported to the Board of Managers of the Institute. If upon such report the Board shall determine to abolish the school, the contributors of the fund for its permanent endowment or their legal representatives shall be called together, and the several quotas subscribed by them shall be returned or appropriated to such other objects as they may severally direct.

The Committee on Minerals and Geological Specimens presented a special report on their progress in arranging the Cabinet of Geological Specimens received from the State of Pennsylvania.

New candidates for membership in the Institute (6) were proposed, and those proposed at the last meeting (7) were elected members of the Institute.

M. T. W. Chandler, Esq., presented the model of a bridge of a similar construction to that about to be erected over the Schuylkill at Market St.

In reply to an inquiry as to the stability of wooden bridges of large span, Mr. S. W. Roberts remarked that although it was undoubtedly true that most of the wooden railway bridges, of large span, throughout the country had, under the passage of a large and heavy traffic, shown signs of giving way, and required bracing since their construction, yet this was due to causes independent of the material of construction, such as increased weight of locomotives and trains, defective plans of construction, &c. He had no doubt but that a properly constructed wooden bridge of large span would be quite as efficient and serviceable as one of other materials.

Mr. Chandler considered that the proposed bridge over Market street would be one of the strongest ever made; indeed, it would be unnecessarily strong—if such a term could be applied—and would bear with ease all the travel that could possibly pass over it.

Mr. Roberts had examined the construction of the proposed bridge, and considered that it would be amply strong.

Prof. Frazer stated that he had recently had an opportunity of examining a Perambulator, invented by Messrs. Escol Sellers & Wheatstone. It is intended to give the horizontal distance traveled, to draw a section of the ground, to mark the termination of each section of 528 feet, and call the attention of the engineer at these points by ringing a bell. Prof. F. stated that Messrs. Sellers & Wheatstone were not yet satisfied with the mechanical execution of the machine, but that the principle was certainly true, and was in his opoinion capable of accurate and economical application.

[We hope at some future time to give a description and drawing of this instrument in our Journal.]

Prof. Frazer made some remarks on the explosion of the steam boiler in the mill in Spring Garden, and stated that he was prevented, at the present time, from making any satisfactory examination into the cause, from the confused state of the ruins, but that it was intended to make a detailed examination as soon as the boiler was accessible.

Geo. W. Smith, Esq., in allusion to the great heat and extraordinary humidity of the atmosphere of the evening, illustrated the same by an exhibition of Mason's hygrometer, which, although not in itself new, might be so to many of the members. It is merely the ordinary dew-point thermometer, in which the wet bulb is kept constantly moistened by means of a bird-fountain placed by its side.

Mr. W. G. Mason exhibited a piece of exquisite weaving from Lyons, in black and white silk threads,—the design a copy of Raphael's Madonna. It had been mistaken by competent judges, at a short distance, for a fine line engraving.

Prof. Walter described the drawings of the new building now being erected for Dr. Jayne, in Chesnut street below Third.

Mr. Smith presented specimens of Marine Glue, prepared by Mr. Jeffries of England, explained its mode of manufacture and use, and alluded to the causes which prevented its successful introduction into this country in some cases. [A glue having some similar properties, but prepared in a different manner and of different material, will be exhibited at a future meeting.]

Dr. Charles M. Wetherill, in the absence of Dr. Turnbull, made some remarks on Benzole, which had recently been proposed as a substitute for oil or gas in lighting. Dr. W. exhibited specimens of benzole obtained from benzoic acid, and from coal naptha;—a jet of air, saturated by means of a simple apparatus with the vapor of benzole, burned with an exceedingly brilliant light. Benzole is also used as a solvent of caoutchouc, which it deposits unaltered, or nearly so, in drying.

A new Refrigerator, made by Messrs. M. B. Dyott & Kent, was shown. This invention will be noticed more at length at some future period.

BIBLIOGRAPHICAL NOTICES.

Report of Prof. Alexander D. Bache, Superintendent of the Coast Survey, showing the progress of that work for the year ending October, 1849.

We have received and read with much pleasure the Annual Report of the Superintendent of the Coast Survey for 1849. The report shows the usual energy and devotion of the assistants, which is of itself the best evidence of the excellence of the principal, and of the success of the work. We are sure that there is no similar work in any country the progress of which has been marked with more ability than this has from the beginning, and since Mr. Bache has taken charge of it, every year has been marked by extensive practical benefit to our commerce, by the discovery of new channels and harbors of refuge, and the marking of new rocks and shoals, in addition to the immense additions to science which will accrue from its labors.

The happy ideas of Mr. Bache of prosecuting the work in different sections of country at the same time—of combining all the scientific power of the country in its prosecution, each laborer in his own appropriate field, and of publishing the results of his work, when important, as fast as they are obtained, have increased its value an hundred fold—produced more economy in its expenditures, and we feel confident made it popular with our citizens. But we have so often—and especially upon the abortive attempt during the last session of Congress to interfere with its successful progress—expressed our opinion both of the value of the survey and of the admirable manner in which it has been heretofore conducted, that we shall confine ourselves at present merely to extracting such passages from the report as appear of a nature to interest our readers. F.

The Kedge-Anchor, or Young Sailor's Assistant. By Wm. Brady, *Sailing Master, U. S. N.; 5th edition. New York: Published by the author*, 1850.

This work is intended "for the youth of our land who follow, or intend to follow, a nautical life. By studying it they will gain a general knowledge of every department of seamanship, and by application and practice in regard to the rules laid down, will soon make themselves proficient in their vocation."

It is evident that the author understands his subject thoroughly, and has handled it ably and practically. The work contains a great deal of sound nautical information. It will also be of great use to the merchant, amateur seaman, and general reader, by its explanation of nautical terms and phrases, and will thus be of especial use to students of maritime law, and to lawyers in their practice in marine courts. We do not hesitate to recommend it as a work of great utility. G.

JOURNAL

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FOR THE

PROMOTION OF THE MECHANIC ARTS.

AUGUST, 1850.

CIVIL ENGINEERING.

On the Motion of Water in Conduit Pipes; on Friction and Pressure in Pipes; and on Jets d'Eau. By M. D'Aubuisson de Voisins, *Ingénieur en chef Directeur au Corps Royal des Mines, &c., &c. Translated by* T. Howard, *for the Civil Engineer and Architect's Journal.**

Continued from page 8.

Equation where Conduits are terminated by Adjutages.

12. We have hitherto considered conduits as entirely open at their further extremity, whereas they are generally terminated by nozzles or cocks, or have some kind of adjutage which contracts the opening, and makes the water issue forth with a velocity different from the uniform motion of the fluid in the pipe: consequently the equations (I. to XII.) based upon the supposition of identity of velocity, do not apply except under that condition. The first member of these equations, $H - \cdot 155v^2$, gives the portion of the head destroyed by the resistance of the conduit; which portion is the entire head H, minus that which remains to produce the velocity of discharge (2): if this velocity is called V, the first member of the equation will, in general, be $H - \cdot 155\,V^2$. The second member is the expression of the resistance of the sides (7), which is a function of the velocity in the conduit, or of v; v ought then to remain as it is in this member, which will not change in value.

13. In conduit pipes, even more, if possible, than in other cases of fluids with unbroken continuity of motion, the velocities, at particular points, are

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* From the London Civil Engineer and Architect's Journal, for May, 1850.

in inverse ratio to their sections: so that if d be the diameter of an adjutage at its discharging orifice, m the coefficient for its particular contraction, D being invariably the diameter of the conduit, we have

$$V : v :: \pi' D^2 : \pi' m d^2; \text{ or}$$

$$V = v \frac{D^2}{md^2} = 1{\cdot}273 \frac{Q}{D^2} \times \frac{D^2}{md^2} = 1{\cdot}273 \frac{Q}{md^2}.$$

The equation for the movement then becomes

$$\left.\begin{array}{ll} \text{[In metres]} & H - {\cdot}08264 \dfrac{Q^2}{m^2 d^4} = {\cdot}002221 \dfrac{L}{D^4} (Q^2 + {\cdot}0432\, QD^2) \\ \text{[In feet]} & H - {\cdot}02519 \dfrac{Q^2}{m^2 d^4} = {\cdot}000677 \dfrac{L}{D^4} (Q^2 + {\cdot}14173\, QD^2) \end{array}\right\} \quad \text{(XVI.)}$$

Of the five quantities which this equation contains, four being given, we may by it obtain the value of the fifth.

It is required, for example, to determine the diameter necessary to give to a circular orifice in a thin plate, fitted to the end of a conduit of ·08 feet diameter, and 532 feet long, the quantity of water to be discharged per second being ·02 feet, and the head 4·5 feet. The above equation will give

$$d = \sqrt[4]{\frac{{\cdot}02519\, Q^2 D^4}{m^2 \left[HD^4 - {\cdot}000677 L (Q^2 + {\cdot}1417 QD^2) \right]}}.$$

Putting in the numerical values $m = {\cdot}62$, and reducing and extracting the fourth root, we have $d = {\cdot}0477$ feet.

14. For velocities above 2 feet per second, we have, (all being in feet,)

$$H - {\cdot}02519 \frac{Q^2}{m^2 d^4} = {\cdot}000711 \frac{LQ^2}{D^4}; \quad \text{(XVII.)}$$

$$Q = 37{\cdot}034 \sqrt{\frac{HD^5}{L + 35{\cdot}47 \dfrac{D^5}{m^2 d^4}}}; \text{ and} \quad \text{(XVIII.)}$$

$$D = {\cdot}235 \sqrt[5]{\frac{LQ^2}{H - {\cdot}02519 \dfrac{Q^2}{m^2 d^4}}}. \quad \text{(XIX.)}$$

Ex. 1.—To a conduit of the dimensions given below we will adapt a conical adjutage ·03 feet diameter: we require to know the quantity it will then discharge?

Here D = ·25 feet; L = 1450 feet; H = 5·32 feet; and for the coefficient for the convergence of the adjutage we take ·90. Consequently,

$$m^2 d^4 = {\cdot}0000006561; \text{ and } 35{\cdot}47 \frac{D^5}{m^2 d^4} = 52795.$$

$$\text{Then } Q = 37{\cdot}034 \sqrt{\frac{5{\cdot}32\, ({\cdot}25)^5}{1450 + 52795}} = {\cdot}01146 \text{ cub. feet.}$$

The complete equation (XVI.) would also give ·01146 cub. feet.

We would here remark that if, instead of an adjutage of ·03 feet diameter, we put one of ·125 feet diameter, (half the diameter of the conduit,) the discharge will be . . ·06551 cub. feet.

With a diameter of ·1875 feet ($\frac{3}{4}$ diameter) . ·06881 "

Without any adjutage, we should have . ·06917 "

These results show that when the diameter of an adjutage is great compared with that of the conduit, (so as to be more than half thereof,) the discharge differs very little from that which we obtain by leaving the conduit entirely open.

In several of my experiments on the conduits of Toulouse, this fact was particularly observed; the difference in some cases was even much less than theory would give—it was imperceptible. For example, having at the end of a conduit of ·164 feet diameter, and 1391 feet long, successively fitted plates pierced with circular orifices, gradually decreasing in diameter, and under a constant head of 53·5 feet, we had the discharges here given. The diameter of the conduit being ·164 feet, the first is the result obtained without any adjutage. We observe that the results of calculation approach so much the nearer those of experiment, as the velocity of the water in the conduit becomes less.

Diameter of Orifice.	Discharge according to	
	Calculation.	Experiment.
Feet.	Cubic Feet.	Cubic Feet.
·164	·07558	·06074
·115	·07417	·06074
·098	·07311	·06074
·066	.06463	·05080
·049	·05192	·04697
·033	·02967	·02896

Ex. 2.—Required the diameter of a conduit 2736 feet long, and from which, with a head of 21·3 feet, we wish to obtain ·4 cubic feet of water per second, by several orifices placed near each other, and which taken together are equal in area to one circular orifice ·13 feet diameter; the coefficient of contraction in this case being taken as ·85?

We have $m^2d^4 = \cdot000206346$; $\cdot02519\,\frac{Q^2}{m^2d^4} = 19\cdot547$; and consequently

$$D = \cdot235\,\sqrt[5]{\frac{2736\,(\cdot4)^2}{21\cdot3 - 19\cdot547}} = \cdot641 \text{ feet.}$$

Art. II.—CONDUITS WITH BENDS AND CONTRACTIONS.

Three kinds of Resistance in Conduit Pipes.

15. We have been hitherto considering conduits as rectilinear, and of equal section throughout their whole length; but they are generally formed with angles or bends, and occasionally have parts of a diminished section, either over a very small extent, (forming, as it were, an annular contraction,) or else through a considerable length. Water moving in such conduits, on arriving at the bends, is compelled to change its direction. In so doing it loses part of its velocity: the resistance which causes the loss is as a force opposed to the motive power or the original head; it destroys a part thereof.

At contractions, again, the fluid experiences another resistance, having there to pass through a narrower section, it requires to have a greater velocity; to obtain this a new effort is necessary, and the consequence is another diminution of the total head.

Thus water, in its motion in pipes, meets, or may meet, with three kinds of resistance—that due to the effect of the sides, and which is by far the most considerable; that which arises from bends, and that from contractions. The forces or portions of the head employed to overcome these lessen the total head, and it is only by reason of the remaining part that the efflux takes place; this portion is the height due to the velocity of discharge.

We have treated in detail the resistance of the sides (4—8); we shall now examine the other two.

The Resistance of Bends and Angles.

16. Every moving body, which after having followed a certain direction suddenly changes therefrom, loses a portion of its velocity, represented by the versed sine of the angle formed by the two directions. If it moves in a curved line, it is continually changing its direction; but the loss of velocity at each change is only an infinitely small one of the second order; and consequently, although the number of losses be infinite, the total loss will be only an infinitely small one of the first order, or as nothing: in other words, every moving body which arrives tangentially at a curve, and follows it for some length, possesses on quitting it the same velocity it had on its arrival. It follows, that if a bend in a conduit be well formed, and the fluid therein should exactly follow the curve, it would suffer no resistance or loss of velocity.

But this is not the case, the molecules composing the fluid current being independent of each other, while those which are in contact with the sides would follow the curvature, the others, being directed against the sides, will be reflected by them, or by the intervening particles, at an angle which is sometimes very considerable. For example, the central fillet aC has a tendency to strike the side ACB at C, and from thence to be reflected in the direction Cb. The mutual action of the particles on one another will produce, in the whole, a loss of velocity; it will be, generally, less than that of the central stream taken alone, but always greater than that of the current bordering on the sides.

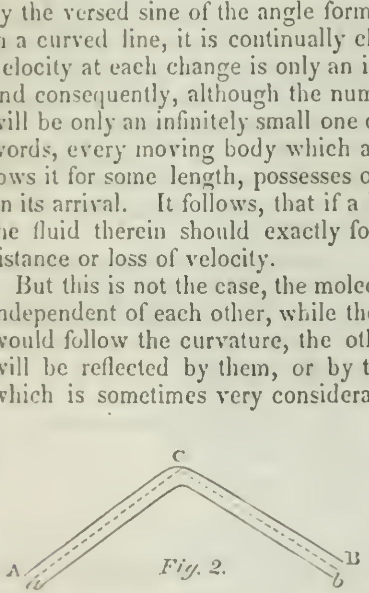


Fig. 2.

This diminution of velocity, and consequently of discharge, although certain, will yet be very slight. Thus, Bossut, with a pipe of 1·06 inch diameter, and 53¼ feet long, laid horizontally in a straight line, and with a head of 1·07 feet, obtained a discharge of ·7360 cubic feet per minute; then having bent it in a serpentine form, so as to have six well rounded curves, all else remaining the same, he obtained ·7205 cubic feet per minute.

We may, however, by multiplying and increasing the acuteness of the bends, render the diminution of discharge very considerable. Rennie, with a lead pipe 15 feet long, ½-inch diameter, fitted horizontally to a reservoir under a head of 4 feet, obtained a discharge of ·419 cubic feet per minute; then having given the same pipe fifteen semicircular bends, of 3¼ inches radius, and again fitted it to the reservoir, the discharge was not more than ·370 cubic feet, so that the fifteen bends reduced the discharge in the ratio of 100 to 89; with a quadruple head, the reduction was in the ratio of 100 to 88.

17. With regard to the laws regulating the resistance of bends, and to its amount, we are indebted to Dubuat for the first well-observed facts. He has taken various pipes, at first rectilinear, and measured the head necessary to obtain from them a certain volume of water in a certain time; he has then bent them in different forms, and in such a manner that the central current had a tendency to be reflected at angles of determined number and acuteness, and again examined the head with which they discharged an equal volume of water in an equal time. The difference between the two heads for the same pipe, at one time rectilinear and at another bent, was evidently the head due to the bends, and consequently the measure of their resistance. The principal of twenty-five experiments which he has thus made are given in the following table:

PIPE.			Velocity per Second.	Resistance due to the Bends.	Coefficient Deduced.
Diameter.	Length.	Angles. Number & Value.			
Inches.	Feet.		Feet.	Feet.	
1·07	10·39	1 of 36°	7·55	·067	·0034
1·07	10·39	2 of 36	7·55	·133	·0034
1·07	10·39	3 of 36	7·55	·221	·0037
1·07	10·39	4 of 24·57	7·55	·133	·0034
1·07	10·39	10 of 36	6·36	·524	·0037
1·07	12·40	4 of 36	5·16	·146	·0039
1·07	12·40	4 of 36	2·60	·036	·0039
1·07	65·46	4 of 36	2·54	·035	·0039
2·13	22·66	4 of 36	7·66	·257	·0030
2·13	22·66	4 of 36	5·22	·118	·0031
2·13	22·66	6 of 24·57 5 of 36 1 of 56·23	7·66	·767	·0038

Dubuat concludes from his experiments, that the resistance arising from bends is proportional to the square of the velocity of the fluid, to the number of angles of reflexion, and to the square of their sines.

In this hypothesis the coefficient varies but little, and its mean value is ·0037. So that if v be the velocity, n, n', &c. the number of angles of reflexion of equal measure, i, i', &c. the respective measures of the angles, the resistance will be

$$\cdot 0037\, v^2\, (n \sin^2 i + n' \sin^2 i' + \ldots\ldots\ldots\ldots\ldots);$$

or in function of Q, and taking s for the sum of the squares of all the sines, $\cdot 0061 \frac{Q^2}{D^4} \times s^2$.

18. In the application of this formula to any given conduit, we must determine the number and value of the angles of reflexion for each bend.

Now a simple diagram shows, 1st, that in a pipe bent to an arc of a circle, (and no other curves need be admitted in practice,) half the diameter of the pipe divided by the radius of the arc will give the versed sine of the angle of reflexion, and we may consequently get its cosine and value in degrees; 2dly, that the number of degrees in the arc, (*i. e.* the supplement of the angle of the curve,) divided by twice the angle of reflexion, will indicate the number of angles.

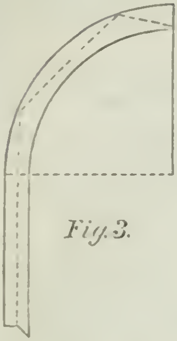


Fig. 3.

Let us, for example, take a conduit pipe ·82 feet diameter, conveying 1·76 cubic feet of water per second, and which presents a bend of 95°, the radius of the curve being 6·89 feet: what will be the resistance occasioned by this bend?

According to the rule laid down, the versed sine of the angle of reflexion will be ·0595 ($= \frac{\cdot 41}{6 \cdot 89}$), and its cosine ·9405 (=1 — ·0591), the cosine of an angle of 19° 52′; this is the angle of reflexion. The arc of curvature 85° (= 180° — 95°) divided by 39·73°, (twice the angle of reflexion,) will give their number; this we shall take as 3, the quotient being 2·14. The sine of 19° 52′ is ·3398, and its square ·1155; the resistance sought for will therefore be

$$\cdot 00608 \frac{(1 \cdot 76)^2}{(\cdot 82)^4} \times 3 \times \cdot 1155 = \cdot 0144 \text{ feet;}$$

a quantity extremely small, although the curve was tolerably acute and the velocity considerable. For the pipe with fifteen bends, in Rennie's experiment, the above method of calculation would give a resistance of ·633 feet; the experiment itself, as we shall shortly see, gave 1·16 feet, which would raise the coefficient of Dubuat from ·00608 to ·01113. But such a case as this seldom occurs in practice; nor does the value of the resistance, even if we double the coefficient, often amount to an inch loss of head.

We may neglect account of the value of this resistance in curves of great radius; the angles of reflexion, it is true, will be greater, but not so strong; and the sum of the squares of the sines, and consequently the resistance, will be less.

19. If the effect of well curved bends is imperceptible, it is not so with angles, properly so called. An experiment of Venturi shows their influence; this *savan* had three tubes made; 1·25 feet in length, and 1·3 inch diameter; one was rectilinear, the second had a bend of 90° well curved, and the third had an acute angle, also of 90°; under a head of 2·88 feet they filled a vessel containing 4·84 cubic feet respectively in 45″, 50″, and 70″. The bad effect of angles is shown still more plainly in the experiments of Rennie; with his pipe 15 feet long, ½-inch diameter, and with a head of 4 feet, he obtained, per minute, a discharge

With the rectilinear pipe . .	·419 cubic feet,
With the fifteen semicircular bends .	·370 "
With 1 right angle . . .	·333 "
With 24 right angles . .	·153 "

so that one angle of 90° reduced the discharge more than 15 considerable bends. This fact alone shows with what care all angles should be avoided in the establishment of conduit pipes.

In seeking the heads which made the three pipes with bends or angles give a discharge (.419 cubic feet) equal to that which was obtained when there was neither angle nor bend, we find them respectively 5·15, 6·33, and 30·52 feet. Deducting 4 feet, there remains for the resistance arising from the bends and angles (17) 1·15, 2·33, and 26·54 feet. From which we conclude that the resistance from a single angle of 90° was more than double that of fifteen bends; and that of twenty-four angles was only 11·4 times greater than that of a single one. This last result also shows that the resistance of angles and bends is not proportional to their number, as Dubuat had remarked. I had also observed a like want of proportion in my *Experiments on the Motion of Air in Conduit Pipes* ('Annales des Mines,' 1828, p. 453).

Resistance arising from Contractions.

20. Contractions, of which we are about to treat, are occasioned by a diminution of the section of the conduit for a very short length.

That we may give an exact idea of the resistance they offer to the motion, let us suppose a conduit in which, perpendicular to its axis, we have placed a diaphragm or thin partition pierced with an orifice. The stream, on arriving at this point, will contract and reduce itself to the size of the aperture, taking a greater velocity in proportion as the section is smaller; and this velocity will always be greater than it would have been in this part of the conduit without the partition. The force necessarry to produce the extra velocity, the direction of the motion remaining the same, will evidently be due to the resistance offered by the contraction.

Let B be the diameter of the orifice, m its coefficient for contraction. The velocity through this point requiring to be greater than in the conduit, and following the inverse ratio of the sections, will be then expressed by $\cdot 0155 v^2 \frac{D^4}{m^2 B^4}$. The excesses of force, or loss of head arising from the contraction, will therefore be

$$\cdot 0155 v^2 \left(\frac{D^4}{m^2 B^4} - 1\right) = \cdot 0155 v^2 D^4 \left(\frac{1}{m^2 B^4} - \frac{1}{D^4}\right).$$

In terms of the discharge, this resistance will be expressed by

$$\cdot 02519\, Q^2 \left(\frac{1}{m^2 B^4} - \frac{1}{D^4}\right).$$

M. Navier, considering that the stream, on passing out of the contraction, immediately resumes the velocity proper to the conduit, instead of the difference between the squares of the two terms, $\frac{1}{mB^2}$ and $\frac{1}{D^2}$, takes the square of their difference, $\left(\frac{1}{mB^2} - \frac{1}{D^2}\right)^2$. But as this opinion is contrary to fact, as the experiments given in the next section will show, we must be careful in adopting a result founded on false premises.

It is but seldom, however, that we shall have to make use of the above formula, for in a conduit pipe there ought not to be any sensible contraction; should one accidentally be found, this formula will serve to give us the value of its resistance. It will generally be slight; in some experiments made with sluice valves fixed in the conduits of Toulouse, I found, after diminishing the section of one of them by $\frac{94}{100}$, that the discharge was only reduced $\frac{1}{100}$.

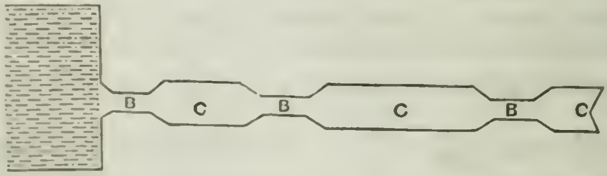
21. If, in the same conduit, below the first contraction there be a second, a third, &c., the resistance from each may be determined by the above formula, and their sum taken.

But, in order that these resistances may be thus added, they must be independent of each other: that is to say, the fluid, after passing through the first contraction, must have recovered the general velocity of the conduit before reaching the second. If it were not so, the fluid stream, after leaving the first contraction, would preserve entirely, or in part, the excess of velocity which it had acquired in order to pass through; and a less effort would be necessary for the second, and less in proportion as the distance between the contractions was smaller.

Eytelwein has made many experiments which fully demonstrate this fact. He took tubes 1·03 inch in diameter, at either end of which was a copper plate pierced with an orifice ·51 inch diameter; their length, or distance between the orifices, being given in the first column of the accompanying table. They were fitted horizontally to a reservoir, and the discharge made by each ascertained; this discharge, as compared with the theoretic discharge, which is represented by unity, is contained in the second column: it goes on gradually diminishing, and consequently indicating the resistance increasing, in proportion as the distance between the two orifices is greater. Eytelwein again fixed in a tube 1·03 inch diameter, four thin plates, each pierced with an orifice of ·256 inch diameter, and at a distance of ·256 inch from each other; the discharge was then ·622. When, however, the plates were placed at the distance of 1·03 feet from each other, the discharge was not more than ·0331.

Distance.	Discharge.
Feet.	
·023	·626
·043	·622
·085	·614
·171	·568
·260	·509
·430	·487
1·030	·481
2·060	·478

22. The observations we have made respecting contractions caused by thin plates pierced with orifices, apply equally to those which would be produced by very short tubes of a diameter smaller than that of the conduit. I cite the 24th Experiment of Venturi. This eminent philosopher, with great judgement, arranged his apparatus to consist of two sorts of tubes alternately; the one B B were ·148 feet long, and $\frac{4}{5}$-inch diameter; the other C C, were 1·9 inches diameter, and their length sometimes ·289 feet, and sometimes ·564 feet. He at first made use of a single tube, C;



then of two, of three, of four, and lastly of five: he successively applied these various combinations to a reservoir, using a constant head of 2·89 feet, and the following are some of the discharges obtained:—

With a single tube, B . .	·0444 cub. feet.
With a tube, C, added . .	·0329 "
With three tubes, C . .	·0252 "
With five tubes, C . .	·0202 "

I have attempted to compare these results with those by the methods of calculation I have given: the differences have been sometimes great, sometimes inconsiderable; thus, for the last case I have had ·0185 cubic feet.

23. Notwithstanding the great irregularities which these results present, they are well worthy attention, and principally on account of the very striking manner in which they show the effect produced by enlargements in a pipe; an effect, carried above a certain limit, altogether as prejudicial as that of contractions.

Venturi's entire apparatus, which was 3·2 feet long, may be considered as a pipe $\frac{4}{5}$-inch diameter, having the five enlargements C. It furnished, as we have seen, a discharge of ·0202 cub. feet. He afterwards, with a tube of the same length, but of the uniform diameter of $\frac{4}{5}$-inch, obtained ·0327 cub. feet. The enlargements thus diminishing the discharge in the ratio of 100 to 62.

24. There is yet one other contraction that ought to be considered—that experienced by the fluid stream on its entry into a pipe of less diameter than that which immediately precedes it. The resistance arising from this contraction will evidently be the same as if, at the entry of the pipe, we had placed a plate pierced with an orifice of which the section should be to that of the pipe as m to 1, (m being the coefficient belonging to the contraction,) and its expression will then be

$$\cdot 02519 \frac{Q^2}{D^4} \left(\frac{1}{m^2} - 1 \right);$$

This is a special case of the general formula (20), where $B = D$.

The value of m can only be approximatively. For a very short pipe, as for cylindrical adjutages, it will be ·82. But in pipes, properly so called, it approaches nearer to 1; and more so in proportion to the length of the pipe, and even, according to M. Prony, as the diameter is greater; so that in large conduits, the effect of this contraction is very small. It is still further reduced by connecting pipes of two diameters by a conical length gradually diminishing from one to the other.

Lastly, as we have remarked (5), the effect of the contraction at the head of a pipe is implicitly comprised in the values of the coefficients of the fundamental equation; and its effect at the entry of a pipe which branches from a larger conduit, will be comprised in the determination of the head of such branch, so that we need not in any case make calculation of it.

Observations on the Practical Application of the Formulæ.

25. The coefficients of the formulæ which we have given, especially those concerning the principal resistance—that due to the friction against the interior of the pipe—have been determined by experiments made chiefly on pipes of small diameter and of no great length (5); they have

been generally well-bored pipes, well joined, and free from incrustations. But can such formulæ be safely applied, without modification, to conduits of a different description—namely, to those used in large distributions of water? This is a question which we must now examine.

The pipes of which conduits are formed are almost always more or less imperfect, from the effect of the mould, or in casting; their section is no longer exactly circular, and consequently, *cæteris paribus*, it is smaller than it ought to be. Their interior surface presents inequalities which retard the motion. When joined, the axis of the whole is not always a line without rebatement; the interior is not a perfectly cylindrical surface; the edges of some of the pipes project, and the currents reaching these points are arrested, divided, and sometimes reflected back again; thus arise eddies in the movement, loss of motive force, and consequently a diminution of the discharge. Even when the pipes are well cast, so that the channel is very regular, there will be, nevertheless, at each joint, a little annular hollow, or a break of continuity, which will produce, to a certain extent, the effect of projections; and which, repeated at every joint in a long conduit, cannot but give rise to a perceptible reduction in the discharge. M. Gueymard, *ingénieur des mines*, has rightly insisted on this cause of reduction, and has endeavored successfully to obviate its effects in the establishment of the fountains at Grenoble.

Moreover, when the conduits are sinuous in their vertical planes, (as is generally the case,) if there are no vents at the summits of the highest parts, the air which the water carries with it, and which is disengaged in a greater or less quantity, rises into these elevated parts, and being there collected produces the effect of contractions, the bad effects of which we have already seen. The cleanest waters, in appearance, always carry with them foreign bodies, and especially extremely fine earthy particles, which are deposited in parts of the pipe, and in time contracting the section again diminish the discharge. I do not here speak of calcareous and siliceous matter, which, although held in solution in the water, become precipitated on the interior of the pipes, lining them with a stony crust, and, gradually increasing in thickness, would end by stopping them altogether, if not removed in time; this evil is peculiar only to certain localities. It is the same with regard to ferruginous deposits, which are made in a tubercular form in the conduits of Grenoble, and which, continually increasing in number and size, diminish the discharge to such a degree that, in eight years, it has been reduced more than one-half. The aërated water, running in pipes, likewise attacks the material, and forms a hydrate of iron, which is deposited in long nipples parallel to the direction of the current, and in greatest quantity on the lower part; underneath these, the iron is as it were corroded nearly to $\frac{1}{16}$th of an inch. ('Annales des Mines,' 1834, p. 203, *et seq.*)

Setting aside these local circumstances, it often happens that in experiments made on conduits apparently in a sound state, the discharge has been found to be less, by a quarter or a third, than that indicated by the formulæ; it is scarcely ever equal to it, I have quoted many of these experiments in my 'History of the Formation of the Fountains at Toulouse.' In consequence of these ascertained facts, the hydraulic engineers of Paris, when making use of the formulæ of discharge, diminish by one-third the value of the numeric coefficients. I have adopted an analogous method, by augmenting by one-half the quantity of water which should determine the size of the conduit. It is, in my opinion, with such latitude that an engineer charged with the establishment of a plan for a large distribution of water, ought to employ the formulæ which we have set forth; he will then avoid the disappointments which would often occur if he uniformly adhered to results given by conduits made with a precision which can seldom belong to his own.

To be Continued.

Extracts from the Report of Prof. Alex. D. Bache, *Superintendent of the Coast Survey, showing the Progress of that Work for the year ending November*, 1849.

Mount Independence,
Near Portland, Maine, October, 1849.

Sir: In compliance with the regulations of the Treasury Department for the Coast Survey, I have the honor to submit to you my report of the progress of the work during the past year, to be laid before the President and Congress.

The reports of the assistants enable me to state the progress of the survey up to the month of October, and in some cases to November. The entire season's work of the parties in North Carolina, and the sections south of it, are thus included; while in part of the eastern sections, and as far south as Maryland and Virginia, the parties are still in the field. Some part of the operations of the survey, including field and office work, has been carried on in every State on the Atlantic coast and Gulf of Mexico; and a beginning has been made on the western coast. The period embraced in the report is in part included in the past, and in part in the present fiscal year.

The report contains:—1. A general statement of the progress of the coast survey, and of the publication of its results. 2. A separate summary of the progress during the past year. 3. The work proposed for the next *fiscal year*, with the estimated cost. 4. A more detailed account of the several operations in each section of the survey, under the different officers, with a notice of the results obtained. 5. An account of the office work for the year. 6. An appendix, containing tables of occupation of parties and results, and reports from the assistants on matters of interest to navigation, lists of maps published, and the like. The sketches appended to it are of two different classes: the first illustrating the progress of the several operations in each section of the coast, and the second, preliminary charts or sketches of important localities examined within the past year. A table indicates briefly the contents of each separate paper in the appendix, and of each sketch. The sketches illustrating the progress of the work are as follows: in section 1, sketch A; section 2, sketch B; section 3, sketch C, and C No. 2; section 4, sketch D; section 5, sketch E, and E *bis;* section 6, sketch F; section 7, sketch G; section 8, sketch H; section 9, sketch I. The preliminary charts are: B No. 2, Buttermilk

Channel, New York harbor; D No. 3, Hatteras Cove; D No. 4, Hatteras Inlet; E No. 2, Bull's Bay, near Charleston. There are, besides, two sheets of diagrams, H *bis* and *tris*.

The operations of the survey are now generally understood, but it is not so generally known that the scientific parts of the work, which give it its great value—its essential value—are not the expensive parts, but that those most eminently practical are the most costly ones. In realizing the idea of Jefferson and Gallatin of a geodetic survey of the coast of the United States, the difference of cost between it and a series of combined nautical and topographical surveys, conducted on equally economical principles, is unimportant, while the difference of value is very considerable.

The capacity of the geodetic method of survey for rapid progress is very great wherever the country is at all favorable to it. I have visited parts of the coast of fifteen of the nineteen States on the Atlantic and Gulf of Mexico, and have a more or less minute acquaintance with the character of most of the other parts of the coast, through the operations of the survey and the reports of the assistants. In nearly the whole extent the facilities for the application of the geodetic method are remarkable. On the coast of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and a part of New Jersey, are lofty hills, rising in some cases to mountains, just such as invite triangulation. On the coast of Connecticut, New York, part of New Jersey, North Carolina, Florida, and Mississippi, there are wide sounds between the main shore and the ocean beaches, which are particularly favorable for the work. Off the coast of Massachusetts, Florida, Mississippi, and Louisiana, there are numerous islands at distances from the main which exactly adapt them to a continuous chain of triangles connecting them with the shore. Indenting the coast of Maine, Massachusetts, New York, New Jersey, Delaware, Maryland, Virginia, Alabama, and Texas, are large bays, across which the triangle sides pass unobstructed. Even where the sounds narrow down, or the islands lie close to the shore, as in parts of New Jersey, Maryland, North and South Carolina, Florida, and Texas, though the triangles are shorn of their dimensions, their symmetry is still preserved, the characteristic accuracy of the system in its distances and directions remains, and the work is readily executed and progress still rapid. The prairies of the coast of Texas afford great facilities for any scheme of triangulation. This reduces the difficult parts of the coast to so small a span that it is scarcely worth considering, and it is remarkable how the constant tendency is to contract this to still smaller dimensions, and how a close examination develops unexpected facilities, diminishing the resources required in applying a method which is as flexible as it is exact.

The magnetic telegraph has given new precision to this kind of survey just in the point in which it was least strong, and has rendered the measurement of an arc of the parallel an operation of the same kind with the measurement of an arc of the meridian.

The triangulation extends unbroken from Maine to Virginia; has been commenced in North and South Carolina, and in Florida; is completed in Alabama and Mississippi, and commenced in Louisiana and Texas.

The plan of commencing the survey in different sections, resting it in each one upon a carefully measured base, and extending the triangles from these bases until they meet, has been dwelt upon in my former reports, and appears to be generally approved by those who have examined it. The steady execution of such a plan to its conclusion, and a clear idea of the directions in which the work should advance to completion, are required, to realize the advantages of the system. It appears fragmentary while in progress, but the fragments fit—the parts are made by rule, and are uniform in character, and will form, when united, a complete and perfect whole. The loss which may be sustained by arresting any portion of the work cannot fairly be charged against the system.

The operations themselves are so essentially connected that confusion and loss would be consequent upon any separation of them. The advantage of uniform scientific methods cannot be overrated. Every part of the work has relation to that which is to follow. The reconnaissance is not made for itself, but for the triangulation. The triangles are not laid out for the sake of triangulation, but in reference to the plane-table work and hydrography which are to follow, and the topography in turn adapts itself to the wants of the hydrography. Thus, from first to last there is unison, and without that the result would be disastrous. The astronomical and magnetic observations have the same practical reference. This is by no means the natural course of things, but results from the union of the different parties in one work. It is easily seen that the same facilities do not occur for each kind of operation in the same place, and that if the operations were dissevered the preceding one might have little value for that which followed. If the land work is not precisely suited in time and in kind to the hydrographic determinations, it is a serious drawback to the latter, and if made without close and entire connexion with it, the result would be waste and inaccuracy.

The several operations of the parties have been carried on according to directions approved by the Treasury Department on the 23d of March, 1849. More or less detailed instructions have been given by me to each of the chiefs of parties on commencing the work of the season, and have been followed up from time to time by others, as the monthly reports or correspondence showed their necessity in executing the plan for the section, in which the operations of several persons and parties employed are combined. Each party keeps a daily journal, an abstract of which is transmitted to the superintendent at the close of the month, with the reports of work done in the different branches of the office. At least once during the quarter the proof-sheets of the engravings in progress are also sent for inspection. The work in the office, the drawing, engraving, and printing, and, as far as practicable, the instrument making and publishing, proceed according to a programme previously arranged. On closing his season's work, about the first of October, the chief of each party makes a report which contains a summary of his year's work. Personal examinations of the operations of the parties have been made by me where it was practicable, and such verifications by me personally, or by one of the assistants, as time and opportunity have permitted. The amount and character of the work executed appear to me highly creditable to the officers of the survey, and in general there has been great economy in the expenditures. High testimony has been borne both at home and abroad to the character and progress of the work, and the comparisons made by your predecessor of the relative expenditures and results of the survey and of similar ones in other countries, (Ex. Doc. No. 26, 30th Congress, 2d session,) showed a very decided difference in favor of our economy. A comparison which I had occasion to institute in my report of last year with the land surveys, showed that in the matter of actual cost per linear mile surveyed, converting our topographical areas into equivalent linear surveys in order to produce similarity of operation, our topographical surveys had the advantage.

In pursuance of the direction of the law to employ as many officers of the army and navy in the work as practicable, applications have been made from time to time for officers in both branches of the service. The hydrography being exclusively executed by officers of the navy, I have added new parties or vessels whenever the progress of the work in the different sections, and the appropriation from which the surveying expenses are derived, would permit. The Navy Department has with great liberality answered these calls, gradually increasing thus the number of its officers upon the work, which now amounts to fifty-four—namely, twenty lieutenants and thirty-four passed midshipmen.*

Within the past year the changes in the officers of the hydrographic parties, from various circumstances, have been so rapid that more than half of those now attached to the survey have been ordered to it since my last report. We have lost three chiefs of hydrographic parties who were most valuable to the work, and whose experience we shall miss, even though their other qualities may be supplied by their successors. One of these officers, Lieutenant Charles H. Davis, has been selected for the important scientific duty of preparing an American Nautical Almanac; and two others, Lieutenants David D. Porter and Richard Bache, have taken steamers to the Pacific.

While the object of Congress to render the survey a school of application is answered by these rapid changes, the work itself suffers in its progress, from the loss of the experience which it imparts. The knowledge of the steam engine acquired in our surveying steamers is of itself of great value to the service, and through it to the country; it is, however, necessarily paid for by the survey. The familiarity with the coast and its harbors which the officers of the navy acquire by this service is also of the highest importance to the country; and the nature of the service and its connexion with the science of the country, are favorable to the development of those qualities in the younger officers which make them ornaments to their profession.

The general progress of the coast survey may be thus summed up. In the first section, sketch A, (Maine, New Hampshire, Massachusetts, and Rhode Island,) the primary triangulation and astronomical and other observations connected with it have reached Portland, Maine, the minute reconnaissance extending to the Kennebeck, and the general reconnaissance to the Penobscot. One party, uninterruptedly engaged in this work, could finish it to the boundary in two to two and a half seasons. A base of verification has been measured on the Boston and Providence Railroad. The secondary triangulation has reached New Hampshire, and the preparation of putting up signals has been carried to Kennebunk, in Maine. The topography has reached Cape Ann, with an interval to be filled on the eastern side of Massachusetts Bay, from Harwich to Scituate. The hydrography of the south shore of Massachusetts is complete to Nantucket Sound, embraces nearly the whole of Nantucket Shoals, and has been completed in Hyannis, Bass River, and Wellfleet harbors of refuge, and in Boston harbor and its approaches. The rest of the work in this section, except the topography and hydrography of part of Narragansett Bay, is complete. Observations for difference of longitude, by chronometer, between Cambridge and Europe, are in progress. The charts of New Bedford, Holmes' Hole, Tarpaulin Cove, Edgartown, and Nantucket harbors have been published. That of Hyannis is engraved. The "general coast chart" from Narragansett bay to Cuttyhunk is engraving. So also the chart of Boston harbor, Muskeget channel, and the second sheet of the coast chart, are in the hands of the draughtsmen. Two manuscript charts, on a large scale, of Boston harbor and its approaches, have been prepared for the commonwealth of Massachusetts and the city of Boston. Preliminary sketches and notices of dangers, and facilities to navigation, developed by the survey, have been published.

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* Since this date, the number has been reduced to eighteen lieutenants and twenty-seven passed midshipmen.

The whole field work of the survey is in general complete in the next section, sketch B, (Connecticut, New York, New Jersey, Pennsylvania, and Delaware,) parts of which require an extension of the work, and others verification or re-survey. This is done as parties are disposable. The chief expenditure in this section is for drawing and engraving. Two charts of New York bay and harbor in six sheets, and one on a smaller scale in one sheet, have been published. The atlas of harbors of Long Island sound is nearly completed. Charts of the harbors of New London, New Haven, Black Rock, and Bridgeport, Oyster bay, Huntington bay, Cawkin's and Sheffield islands, Captain's islands, east and west, and of Fisher's Island sound, have been published. The chart of Sachem's Head is engraved; leaving only the mouth of the Connecticut, the anchorage at Hart and City islands, and perhaps an additional chart to be engraved. The eastern sheet of the general chart of Long Island sound has been published, the middle sheet is engraved, and the western is in the course of engraving. The western sheet of the south side of Long Island is engraved, and the middle and eastern sheet drawn. The off-shore chart, comprising the coast of Connecticut, New York, and New Jersey, from Block island to the capes of the Delaware, is drawn and nearly engraved. A chart of the passage between East River and Long Island sound, (Hell Gate,) has been drawn. Buttermilk channel, in New York harbor, has been re-surveyed, and a chart published. The Delaware bay and river, in three sheets, including the approaches, has been published. A chart of Little Egg harbor (of refuge) on the coast of New Jersey, has been published. A part of these engraved plates are electrotyped, so as to use copies which are facsimilies of the original.

In the next section, sketch C, (Delaware, Maryland, and Virginia,) the primary triangulation, and secondary connected with it, will be completed in less than three years, having now reached the Rappahannock in their progress down the Chesapeake. The secondary triangulation on the outer shore is similarly advanced. The triangulation to connect the primary work and the capitol requires the occupation of but one station to complete it. A base of verification has been measured on Kent island. From the Seaton station, at Washington, we expect to reach all the principal points on the coast through which the telegraph passes, determining the differences of longitude with a precision not heretofore attained. Washington, Philadelphia, New York, Cambridge, and Cincinnati, (one of the steps to New Orleans by the western telegraph routes,) have been thus connected, and the astronomical observations at Western Reserve College have been rendered available for our work by its telegraphic connexion with Philadelphia. The topography in this section, both of the shores of the Chesapeake and ocean shore, has kept pace with the triangulation as nearly as the convenience of the work permits. The hydrography of the Chesapeake has rather pressed upon the land work, and that outside follows it closely. An efficient *steam vessel* is much wanted for this part of the work; otherwise, as the Chesapeake widens, and the soundings come to embrace the mouth of the bay outside, the hydrography cannot keep up with the rest of the work. With a steamer which could keep the sea one hundred days during the working season, the main hydrography of this section would be completed in five years, and probably at no greater annual expense than now. Charts of Annapolis harbor and the entrance to Chester river have been published. A chart of the Patapsco and Baltimore harbor in two sheets is nearly engraved. The upper sheet of Chesapeake bay is drawn and engraving, and the drawing of a second sheet will soon be in progress. Materials for a third will at the close of the season be in the office, and will be at once reduced.

In the fourth section, sketch D, (Virginia and North Carolina,) the main and secondary triangulation of Albemarle sound, and the tertiary triangulation of the rivers emptying into it, except those at its head, and the topography of the shores, are completed. The triangulation of Croatan and Roanoke sounds, and the topography of the shores, are nearly completed. A base line has been measured on Bodie's island. The triangulation of Currituck sound is in progress, and that of Pamlico sound commenced. A small triangulation along the ocean shore is in progress to Cape Hatteras. The hydrography of Albemarle sound is two-thirds done. Hydrographic reconnaissances have been made of the inlets between Nag's Head and Hatteras inlet. The reductions are in progress for a map of Albemarle sound. The chart of Pasquotank river has been drawn, and is nearly engraved. This is the section having the smallest extent of shore line of the nine sections on the coast of the Atlantic and Gulf of Mexico, and the progress of the land work in it, in between three and four years, amounts probably to one-third of the whole. Had the steamer "Jefferson" answered our expectations, we should have been able to speak as positively in regard to the hydrography.

In section five, sketch E, (South Carolina and Georgia,) a general reconnaissance of the coast has been made, so as to decide upon the plan of the work, and to form an idea of the difficulties and facilities in different parts of the section. This is one of the newest sections, the work having been only commenced in it in the winter of 1847–48. The land work of Charleston harbor has been completed, including the triangulation and topography, and the astronomical observations required have been made. The approaches to the harbor from the ocean have been sounded out. A hydrographic reconnaissance has been made of Bull's bay, on the coast of South Carolina, important as a harbor of refuge. The computations required for the chart of Charleston harbor have been made, and the drawing is in progress. A sketch of the harbor of Bull's bay has been published. The base line for the main work has been laid out on Edisto island, and the arrangements for its measurement are in progress. The sides of the main triangles have been traced from the base to the stations east of Charleston. The small secondary triangulation will be pushed both south into Georgia and north from the base, so as to serve as a minute reconnaissance for the primary.

The sixth section, sketch F, (part of Florida,) was commenced last winter by a reconnaissance of the Florida reefs and keys; and a special appropriation being made by Congress, the triangulation was at once commenced near Key West and Bahia Honda, and astronomical observations were made for fixing the geographical position of Key West. The rapid advance of summer, and other circumstances, necessarily prevented more than a beginning there, and the parties are now under instructions to resume work as early as the season will permit. Two land parties, (one a double one,) and a hydrographic party, have been organized for the purpose. The plan of operations proposed, and the reasons for it, will be described in a subsequent part of my report. More than two-thirds of the part of the coast of Florida which is comprised in section seventh, sketch G, has been reconnoitered, and work may be commenced there whenever the appropriation permits. A hydrographic reconnaissance of the entrance to the St. Mary's and St. John's rivers has been made.

The eighth section, sketch H, (Alabama, Mississippi, and Louisiana,) was commenced by a reconnaissance in 1845, and the work has made very good progress in it. The triangulation of the delta near the city of Mobile, and of Mobile bay and Mississippi sound, to Cat island and the shores of Lake Borgne, is nearly complete, and the topography more than half advanced to completion. The positions of two points have been determined by astronomical observations. A base line for the work has been measured on Dauphin island. The hydrography of nearly two-thirds of Mobile bay is done, including the entrance; part of Mississippi sound and Cat and Ship island harbors are complete. The charts of these harbors have been drawn, and the engraving is nearly completed. The chart of the entrance of Mobile bay is in the hands of the draughtsman. Sketches of hydrographic reconnaissances of Cat and Ship island harbors, and of Mobile entrance, have been engraved and distributed. The work in this section will be recommenced as soon as the season permits.

The ninth section, sketch I, (part of Louisiana and Texas,) was commenced but two years since. Galveston (upper and lower) bay has been triangulated on a base approximately measured. Astronomical and magnetic observations have been made at one station, and it has been connected by chronometer differences with a station in section eighth. It is proposed this season to carry the triangulation south from Galveston, and to commence the topography and hydrography of Galveston bay. The work will be thus in full activity.

Instructions for commencing section tenth (the coast of Oregon) were given by the Treasury Department in July, 1848, and in the course of the autumn a land and hydrographic party were organized to proceed to Oregon. The land party is complete within itself for all the operations of the survey. The very unexpected change in the relations of the western coast has, of course, interfered materially with the usefulness, and added greatly to the expense of the parties. At the last advices, however, the schooner Ewing had arrived at San Francisco, having passed through the Straits of Magellan, under the command of Lieutenant Washington A. Bartlett. Lieut. Commanding McArthur, United States Navy, the chief of the hydrographic party, had also, after many delays and difficulties, not to say dangers, reached the same point, and thus Assistant James S. Williams and his party (Brevet Major Hammond, Sub-Assistant Joseph S. Ruth, and Wm. Humphreys, Esq.,) were furnished with the means of transportation, which had been entirely wanting before, to reach the coast of Oregon. I have no doubt, should our means prove adequate, I shall be able to give a good account of the labors of these parties.

This cursory glance at the work on our extended coast which has been done, will, I trust, serve to give confidence in the steady advance towards completion of all parts of the survey. In four of the sections data exist for a tolerable approximation towards the time of completion of the different parts of the work, with the means as they now exist; in four others they will be furnished in three years, making at that time eight of the sections in regard to which the estimates of time of completion may be presented with reasonable pretensions to accuracy. I have endeavored, in passing, to indicate some of the periods when, as now supposed, the operations will be completed.

As the sums directly appropriated for the coast survey, and those indirectly furnished by the War and Navy Departments in supplying officers, and the latter officers and men for the survey, have increased, the rate of progress of the work has been in a higher ratio; and I have endeavored, in forming reports, to show the economy which thus resulted from enlarging the scale of the work, while the period at which its benefits were felt was hastened, as well as that of the entire completion of the survey. Besides the general account just given, it is proper to state the progress during the past year separately from that of former ones. This notice I shall endeavor to render as brief as possible, as a full detail will be given in the subsequent parts of the report of all the operations derived from the reports of the officers engaged in them, and my own examinations. Each individual engaged in a work like this has a right to claim that he shall, as far as the case admits, receive full credit for work done, and the public statement by the head of the survey, of the amount of service rendered, is, at least in part, a fulfilment of his duty in the matter. With many, the opportunity of thus having their labors appreciated by the public, while it is a reward for exertion, also reacts as a stimulus. With all, the occasions of preparing annual reports serve as so many periods of reflection upon progress made, and of plans of operations and their relative degrees of success.

To be continued.

For the Journal of the Franklin Institute.

On the Construction of Permanent Road on Lines of Railway, and the Deterioration of the same. By John Hampson, Esq., *Engineer and Superintendent of the New Orleans and Carrollton Railroad.*

The construction of "Permanent Road" on lines of railway, and the deterioration of the same, have engaged the attention of many eminent engineers, as well as directors and others interested. An interesting report on this subject will be found in the proceedings of the Institution of Mechanical Engineers, recorded in the Civil Engineer's and Architect's Journal for June, 1849, which enumerates several different methods, and sets forth the conditions necessary to secure stability. The different modes of construction mentioned are stone blocks, various arrangements of cross sleepers, longitudinal bearers, with and without cross sleepers. The plan of sills under cross ties is not mentioned, which, for the combination of stability, facility of repairs, and surface drainage, (which it will be admitted are very desirable conditions,) is, in my opinion, far preferable to any of the plans specified. It is true the first cost of this method of construction is somewhat more than that of longitudinal bearers on cross ties, but the advantage of having the sill timber covered and excluded from the action of the air, (consequently increasing its durability,) and the diminished liability of the ballast being crushed out sideways, (on account of the weight of it, or earth above the sill,) with the other conditions it affords, will well repay the extra cost, whilst, with a good rail and the cross ties sufficiently close to bear the traffic, it will be as steady as the longitudinal bearer system, which requires the best kind of timber, and which is more exposed to the action of the weather; besides it involves the necessity of taking up at least two rails to replace a defective piece, while, in the sill arrangement, a defective cross tie can be replaced without removing any rail.

I have adopted the sill plan in relaying one of the tracks of the New Orleans and Carrollton Railroad, and it has been tested in an extraordinary manner, for *immediately* after its completion a portion of it was submerged by the water from a crevasse in the levee of the Mississippi, so that the top of the rails were two inches under water for over a month; and in consequence of the other track having given way, it had to be, and was, constantly used during that time for trains of from one to three hundred passengers. It is now in use, and has not required the least amount of repairs; nor has it settled or given way in any particular. It will, perhaps, be difficult to credit this statement,—it is, nevertheless, true, and can be substantiated by numbers of thinking men. The alluvial nature of the soil, and the absence of anything like ballast, prompted the use of shells for a substratum. These shells are found in immense banks or piles on the shores of the lakes in the vicinity, in some cases elevated 20 feet above the surface of the water. They are a bivalve of about 1½ inches in diameter, in shape similar to the clam, and are of a species of which I have not seen a living specimen. The shells cost, delivered on the railroad, 25 cents per 4 cubic feet. This price, with any regard to economy, makes their application limited.

The plan I have adopted to secure stability and facilitate drainage with the least expenditure of shells, is to dig a cross trench every 20 feet of 20 inches wide, and sufficiently deep to allow six inches in thickness of shells, on which is laid a cross plank 2½ × 15. This is well rammed down to the level required, (by two men, with a piece of solid timber about 5 × 8 inches, and 7 feet long, thinned in the middle for convenience of handling,) when it is secured from springing or rising up by a stout stake driven at each end, to which it is nailed. These cross trenches are dug out to the side ditches and filled with shells to form blind drains. Longitudinally under each rail a trench of 20 inches wide is dug, in which shells are put from 6 to 10 inches deep, according as the soil is more or less aluminous, on which are laid plank 2½ × 15 inches, and 20 feet long, or such length as will reach from centre to centre of cross planks. These planks are well rammed down as before, till they rest on the cross plank, to which they are nailed; and to keep them down in the centre they are nailed to a stout stake driven on each side. On these planks others are laid, 2½ × 12 inches, so as to break joints, and nailed on the edges, so as just to keep them from springing up; this constitutes the sill. On this I put cross ties 5 × 8 inches, so as to lie well, which are fastened down by 1½-inch trenails, the holes for which are bored in each end of each cross piece, alternately slanting, completely through the sill plank, thus holding the two planks and cross piece firmly together, and, in fact, splicing the sills from end to end in a most efficient manner. The cross pieces, which are three feet from centre to centre, are then adzed down to the level, and the rails laid; the track is then filled up with earth and finished. This is the construction which was submerged, and which has stood the test so well.

It may be as well to mention the size and weight of rails, also the plan of chairs and joints. The rails are in 21 feet lengths, of the H or double T pattern,—are 3 inches high, 3½ inches base, and weigh 54 lbs. to the yard; the ends are sawed off square, and a piece punched out of each corner of the base, so as that, when they are put together, a space will be left between them for a ½-inch square T-head spike, which holds the rails down and prevents end movement. I applied India rubber under the joints in a single-lipped chair, a drawing and description of which is given by me in the Railroad Journal for May 26, 1849, appended to the advertisement of Mr. J. C. Smith, the patentee for the application of India rubber under the rails of railroads. The joint still remains as perfect as then stated, and I can now recommend it with still more confidence since the severe trial to which the road was subjected.

The stability of our road under such circumstances has prompted me to write this detailed description, to the end that others who may have to construct a railroad on so bad a soil, with a scarcity of ballast, may see what has been done, and perhaps to add something worthy of note to the general stock of knowledge on the subject of the construction of permanent way.

AMERICAN PATENTS.

List of American Patents which issued in May, 1850, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Printing Presses;* F. J. Austin, City of New York, May 7.

Claim.—"I claim the mode of governing the vertical motion of the type bed, by the conjoint application of the crank and two part pressing bar, made as a hollow cylinder and slide, with a stop shoulder to give the upward motion, and pressure, and arranged to lengthen by sliding out at the back motion of the crank, and the combination therewith of the grooved cam and backing bar to regulate the descending motion of the type bed as described.

"I claim the application of the rotating cams to act through the fork and connect or disconnect the clutches, to give the shaft *c* 6 a rotary motion during half the rotation of the shaft *b*, and suspend the motion of the shaft *c* 6 by the disk and pins on the fork during the other half of the rotation, so that the shaft *b* goes two continuous revolutions to one intermitted revolution of the shaft *c* 6, such intermitted revolution being applied to give an intermitted alternate motion to the double paper carriage in a printing press, or to give any similar intermitted alternate motion by any competent means substantially as described and shown.

"I claim the application of the crank, male wheel, fixed female wheel and connecting bar for the purpose of communicating the intermitted alternate motion to the double paper carriage, substantially as described."

2. For an *Improvement in Bran Dusters;* Ezra R. Benton, Milwaukie, Milwaukie county, Wisconsin, May 7.

The patentee says,—"The nature of my invention consists in the construction of a machine for separating the flour, shorts, and dustings from bran as it comes from the bolts, which machine or bran separator, as it is called, is composed of one exterior stationary and two interior revolving cylinders, so formed and arranged that the interior cylinders rotate in opposite directions and agitate the bran and other stuffs subject to their action, and separate the flour, shorts, and dustings from the bran, depositing each quality of stuff in different receptacles, and thereby saving a large per centage of flour, &c., which would otherwise be left in the bran, and greatly increasing the profits of milling."

Claim.—"What I claim as my invention, is the combination and arrangement of the exterior stationary shell or cylinder, the intermediate revolving cylinder covered in sections with wire cloth of different qualities, and the central revolving cylinder with the ventilator for the admission of air, and the openings between the staves in the cylinder for the emission of air to drive the flour and other stuff separated from the bran, through the wire cloth, the several parts with their driving gear and apparatus being constructed and arranged substantially as herein described and intended for the purposes set forth."

3. For *Improvements in the Construction of the Frame, Roof, and Floor of Iron Buildings;* James Bogardus, City of New York, May 7.

The patentee says,—"The first part of my invention consists in making the horizontal beams which form the horizontal parts of the frame work, in sections cast with flanches through which longitudinal bolts pass to secure and draw together the sections at their junctions, their upper and under surfaces being horizontal and parallel flanches when this is combined with vertical columns, pilasters, or posts, also cast with horizontal flanches at top and bottom, provided with bolt holes in the horizontal flanches of the beams, the top end of one column, pilaster, or post, and the bottom end of another being bolted to the lower and upper horizontal flanges of two beams, to bind together the same in addition to the bolts which draw together the beams.

"The second part of my invention which relates to the method of making the floors, consists in making such floors of narrow plates or sheets of metal with tongues and grooves made on the edges by rivetting to the under surface of the plates, or sheets, a strip of sheet iron to form the tongue, and one or two strips to form the groove, the said strips acting at the same time as ribs, to give stiffness to the plates or sheets which constitute the floor, all the said plates being arranged, when put together, to break joints, by which means I am enabled to make a floor which, for rooms of ordinary size, needs no intermediate supports.

"The third part of my invention which relates to the method of covering the roof by means of a series of plates, consists in making one edge of each plate with a groove in the same manner as in the door plates, to receive the opposite edge of the next plate, and thus make one plate lap over the other, and bind the two together that they may not be separated to permit the passage of water, these plates being also provided with cleats or small plates rivetted on one end of each plate, and made to overlap the end of the next, and projecting beyond the lower edge of the large plate to lap over a corresponding and like plate or cleat on the next plate, and thus lap all the joints of the roof."

Claim.—"What I claim as my invention, is the method substantially as herein described. of making the frame work of iron houses of more than one story, by means of beams cast in sections with end flanches, which receive bolts for uniting and drawing them together, and with top and bottom parallel flanches; when this is combined with columns, pilasters. or posts, cast with horizontal flanches at top and bottom, the top flanch of one column and the bottom flanch of another being secured by bolts to the horizontal flanches of two beams, one column above and the other below the point at which the beams are joined, for the purpose and in the manner substantially as described.

"I also claim the method substantially as herein described, of making the floors by means of thin plates of metal formed with a groove on one edge and tongue on the other, by rivetting narrow strips of metal to their under surface and near the edges, the plates so formed being put together breaking joints substantially in the manner and for the purpose specified.

"I also claim the method substantially as described of covering the roofs of houses by means of series of thin metal plates or strips to the under surface thereof, that the edge of one plate may fit into the groove on the lower edge of the next above, and so on throughout the series substantially as described, when these plates are also provided with the lapping pieces or plates, riveted or otherwise secured to the upper surface of one end of each plate in each series to lap over the end of the contiguous plates of the next series, the said lapping pieces of each series being also made to lap one over the other substantially as and for the purpose specified."

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4. For an *Improvement in Air Heating Stoves;* James L. Cathcart, Washington, D. C. May 7.

Claim.—"What I claim as my invention, is, 1st, a grate combined with and around the hollow cylinder through which the air passes and becomes heated.

2d, A conical hood placed above the air cylinder and the grate, and connected with a smoke pipe for the purpose of creating a draft concentrating the heat and conducting off the smoke or gas from the burning wood or coal.

"3d, The placing the grate on friction rollers as described in connexion with the cylinder, for the purpose of clearing the grate of ashes or bringing any part of it under the operation of a stronger draft or current of air.

"4th, The combination of the air pipes or air passages with the hood as described, by which the air that has become heated in the cylinder is conveyed to the room or place to be warmed.

"5th, The circular fender which is also made to answer the purpose of a blower by being raised and connected with the hood as described.

"6th, The method of introducing air into a hollow cylinder or air chamber connected with and inside of the grate, and taking the air from beneath the hearth."

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5. For an *Improvement in Bedstead Fastenings;* Harrington & Coolidge, assignees of Chas. C. Coolidge, Boston, Massachusetts, May 7.

Claim.—"What I claim is the lip in combination with the pawl and ratchet are substantially in the manner and for the purpose as described; and when the bedstead bottom is made of the said flexible strips having such a flexibility as to enable them to be readily wound upon the windlass, and unwound therefrom as stated.

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6. For an *Adjustable Mouth Piece to Road Scrapers;* Shadrach Davis, Dartmouth, Bristol county, Massachusetts, May 7.

Claim.—"What I claim as my invention. is combining with the body of a scraper a mouth piece, which can be adjusted to form various angles with the bottom of the scraper substantially in the manner and for the purposes described."

7. For an *Improvement in Mechanical Leeches;* Marcellin Delluc, City of New York, May 7.

The patentee says,—"The nature of my invention consists in the construction of two instruments, the first designed to create a vacuum upon the skin, and to pierce it with a lancet shaped like the letter V pressed smartly by a spring; the second, intended to be placed upon the puncture thus made, draws the blood by making a vacuum like a pump."

Claim.—"What I claim as my invention, is, 1st, the arrangement of the wire, of the button, and of the covering of the instrument connected with the piston rod by the India rubber tube, which allows the cylinder placed in the vacuum produced by the piston, to work without admitting the air.

"2d, The blades of the lancet shaped like a V."

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8. For an *Improvement in Defecating Sugar;* Robert de Massy, Paris, France, May 7.

Claim.—"I claim the process as described for the immediate separation of the sugar from all foreign matter, which injures the purification by the manner above set forth, by forming a solid saccharate of baryta, pressing, decomposing, and separating the solid cakes, and finishing the process as set forth to the almost total suppression of heat necessary to evaporation."

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9. For an *Improvement in Over Shoes;* Peter Dorn, Philadelphia, Pennsylvania, May 7.

The patentee says,—"My improvement consists in the manner of affixing an over shoe to a boot or shoe."

Claim.—"What I claim as new, is an over shoe covering the front of the boot at the sole, substantially in the manner and for the purpose set forth."

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10. For an *Improvement in Plough Cleaners;* Daniel D. Gitt, Butler Township, Adams county, Pennsylvania, May 7.

The patentee says,—"The nature of my invention consists in the combination of a vertical wheel, a rack, or notched arm, and a lever with a conical fluted roller placed under the beam and upon the cutter of a plough, for the purpose of working the said roller in the operation of ploughing and cleaning the plough; and also, the substituting for this arrangement (if desired) a self-acting combination, consisting of a self-adjusting wheel running in the furrow, having a crank connected with it, with a pitman working a lever attached to the rack or notched arm used in the first arrangement, and (the progress of the plough putting the wheel in the furrow in motion) by means of the crank, pitman, lever, rack and vertical wheel operating the conical roller, and thus cleaning the plough in the operation of ploughing."

Claim.—"What I claim as my invention, is the combination of the lever, notched arm and vertical wheel, with a conical roller placed under the beam and upon the cutter of the plough as above described, for the purpose of operating the cónical roller and cleaning the plough in the operation of ploughing, as setforth."

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11. For an *Improvement in Cooking Stoves;* James R. Hyde, Troy, New York, May 7.

The patentee says,—"The nature of my invention consists, 1st, in the manner of constructing the fire box so that it shall not crack in the expansion and contraction to which it is subject from the great and unequal degree of heat to which it is exposed. 2dly, in the so-arranging of a flue in front of the stove as to admit the smoke and gases when the summer arrangement is used in boiling, &c., so that it has a free draught to enter the fire chamber above the fire; and 3dly, in dividing the sliding part of the hearth, so that either half shall slide under the stationary part or ends of the hearth in such a manner as that the sliding hearth is entirely out of the way, without the inconvenience resulting from having it project out beyond other parts of the stove as is usual."

Claim.—"What I claim as my invention, is, 1st, the mode herein described of constructing fire boxes for stoves, furnaces, &c., in two pieces, so that they are not confined as they are when made whole, or four pieces as described, but is free to move on its bed plate.

"2dly, I claim the manner herein described of dividing the sliding hearth of cook stoves in such a manner as to admit of its sliding under the stationary part, and be entirely out of the way: the whole being constructed in the manner and for the purpose, substantially as herein described."

12. For an *Improvement in the Screw Excavator;* Richard Montgomery, City of New York, May 7.

The patentee says,—"My invention is designed to effect the purposes of excavating either in or out of water, dredging mud, removing sand bars, deepening canals, elevating auriferous sands, loading coal, &c., on vessels or wagons, &c., &c."

Claim.—"What I claim as my invention, is, 1st, the employment of a screw excavator combined with an adjustable tube as above described, for the purpose of excavating and conveying off earth, said tube being placed at any angle, or vertically, or horizontally, as the case may require.

"I also claim the apparatus for sustaining, moving, and guiding the excavator as above described, by which it is combined with the prime mover so as to be readily pointed in any direction, said apparatus consisting of a ring with shifting bearings and a movable bearing for the shaft to rest in, which is connected with the prime mover by universal joints."

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13. For an *Improvement in Cooking Stoves;* Jordan L. Mott, City of New York, May 7.

The patentee says,—"The first part of my invention relates to the protecting of the boiler hole covers from the injurious action of intense heat, by lining such covers with a concavo-convex metal plate, which will bend to yield to the expansion and contraction due to the varying heat to which they are exposed and against which they protect the covers.

"And the second part of my invention relates to the supporting the oven and other doors when open, and consists of a lever or arm jointed or hinged to the body of the stove, and so connected with the door, that when the door is let down the said lever or arm is turned out to make a support on which the door rests."

Claim.—"What I claim as my invention, is the method of protecting boiler covers against the injurious action of varying temperatures, by combining therewith a lining made of metal so formed that in its cross section it shall present a curved line, that is, a line longer than a straight line as described.

"And I also claim the method of supporting the doors of stoves by means of a lever or levers, so connected with the doors, substantially as described, that the said lever shall be moved in and out by the closing and opening of the doors as described."

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14. For an *Improvement in Working a Rotary and Vertical Churn Dasher;* William R. Wash, Bridgeport, Fairfield county, Connecticut, May 7.

The patentee says,—"The nature of this invention consists principally in so arranging and combining in the same churn and upon one shaft, a horizontal rotary dasher, and a vertically vibrating dasher, that while the rotary dasher is operated for the purpose of agitating the cream, the vibrating dasher remains at rest; and that when the butter is produced the vibrating dasher may be operated for the purpose of gathering or consolidating the butter, and that without changing the connexion of the machinery while the rotary gear remains at rest."

Claim.—"The application of the shaft to communicate a vertical reciprocating movement to the dasher F, and a rotary one to the dashers M and G, so that either can be used as desired, as herein set forth."

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15. For an *Improvement in Straw Carriers;* William Pierpont, Salem, Salem county, New Jersey, May 7.

The patentee says,—"My invention consists in the peculiar construction of a seed separator and straw carrier, and its adaptation to a threshing machine, by which the straw is removed and the grain separated from it in a more effectual manner than by any other plan hitherto in use."

Claim.—"What I claim is an elongated apron or pierced platform, hung upon and worked by cranks connected with and forming a part of the threshing and separating machine, substantially in the manner and for the purposes herein described."

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16. For an *Arrangement of Several Slide Valves in the same Steam Chest;* Cyrus Richardson, Woburn, Middlesex county, Massachusetts, May 7.

The patentee says,—"My improved arrangement consists in making two or more valve seats in the same steam chest, with a valve cup to each seat—one of which is made in the usual form and is used when the engine has to draw its ordinary load, and the valve cups to the other seats are made of various lengths, longer than is usual, and are used when the engine has less than its ordinary load, and graduates the quantity of steam used so as to apportion it in some measure according to the load, and thus enables the engineer to economize or reduce the quantity of fuel used to generate the steam.

"This is effected by stopping the ingress of the steam into the cylinder when the cylinder is one third, one half, or partially filled with steam, and by this means the expansive force of the steam is gained."

Claim.—"What I claim as my invention, is the arranging of two or more valves in the same steam chest, to open or close the several steam ports or passages leading to and from the cylinder of a steam engine, arranged and operated to graduate the admission of steam into the cylinders of steam engines in the manner and for the purpose substantially as above set forth."

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17. For an *Improvement in the Manufacture of the Oxide of Zinc;* Edme Jean Leclaire and Jean Joseph Ernest Barrnel, Paris, France, May 7; anté, dated Dec. 31, 1845.

The patentees say,—The object of the present invention is a complete reform in the art of painting, by substituting unalterable and harmless paints for those having lead and copper, which are poisonous substances, for a basis, and which are liable to speedy alteration, and never produce perfectly clear tints.

"This reform is effected by the discovery of methods of obtaining on a large scale the white and yellow of zinc and barytes, zinc green, and antimonial red, which products used as such, or combined with other harmless and unalterable colors employed in painting, form a complete scale of colors with all the intermediate grades."

Claim.—"What we claim as our invention, is, 1st, the use of a draft of air through the suction tubes described above, for oxidizing the metal and carrying forward the products, and the arrangement of tubs or basins for the reception of the heavier portion of the products as described.

"2d, The arrangement of the oxidizing chamber in combination with the receiving chambers, so as to allow the products which they contain to be gathered without entering the chambers."

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18. For an *Improvement in the Melodeon;* Amos L. Swan, Cherry Valley, Otsego county, New York, May 7.

Claim.—"What I claim as my invention, is, 1st, the employment of the arms in combination with the top of the bellows in the manner and for the purpose set forth."

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19. For *Improvements in Oscillating Valves of Steam Engines;* Thomas C. Theaker, Mansfield, Richland county, Ohio, May 7.

The patentee says,—"The nature of my invention consists in forming side passages or steam ways in the oscillating valves, and communicating with recesses formed in the valve chambers for the purpose of letting steam into said last named recesses, in order to produce a pressure of steam against the side of the valve opposite to that on which the steam is admitted, so as to produce a counter pressure on the oscillating valves for the purpose of reducing the friction on the same as described."

Claim.—"What I claim as new, is the recess sunk in the oscillating valve and communicating with the steam passage, in combination with the recess formed in the valve chamber, the same acting in the manner and for the purposes herein specified."

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20. For an *Improvement in Machines for Polishing Stone;* Amos Walter, Middletown, Shelby county, Indiana, May 7.

Claim.—"What I claim as my invention, is the manner or mode of giving a compound or double motion to the rubbers by means of two carriages, or a double carriage, each carriage moved by its respective cranks, substantially in the manner and for the purpose described, so that one motion of said rubbers will not interfere with the other motion; said machine can be propelled by any power now in use."

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21. For an *Improvement in Machines for Slitting Clothes Pins;* Oratia P. Allen, Rindge, Cheshire county, New Hampshire, May 14.

The patentee says,—"The object and purpose of my improvements, and the effect or result accomplished by them, is to cut the outer end of the elongated slot or fork of the pin in a spreading form, (which is very desirable,) and to accomplish this by knives, formed on or attached to the same circular saw which forms the straight part of the slot, and this has never been successfully accomplished prior to the invention of my improvement."

Claim.—"What I claim as my invention, is cutting the two sides of the outer end of the slot or fork of a clothes pin on a regular sweep, by means of knives formed alternately on each side of the circular saw which cuts the straight part of said slot; and in the direction above explained, whether said knives be made of portions of the plate of said saw, and bent outwards as described, or in separate pieces, and attached to said sides of said saw."

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22. For an *Improvement in Stoves;* Anson Atwood, Troy, New York, May 14.

Claim.—"What I claim as new, is, 1st, the air chamber in which the air is heated previously to its admission to the fuel, in combination with the spiral apertures by which the heated air is caused to impinge on the upper surface of the fuel, substantially in the manner and for the purposes as described."

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23. For an *Improvement in Connecting Rods of Steam Engines and other Machinery;* Levi Bissell, City of New York, May 14.

Claim.—"What I claim as new, is the application of prepared India rubber, or of any similarly effective elastic substance in the parts forming the joints of connecting rods of steam engines and other machinery, for the purpose of preventing jars and breakage of the parts when a reciprocating motion is changed to a rotary, substantially in the manner described and shown."

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24. For an *Improvement in Steaming Grain Preparatory to Grinding;* Israel Jackson, assignee of Benjamin S. Broomell, London Grove, Chester county, Pennsylvania, May 14.

The patentee says,—"The nature of my improvement consists in causing the grain as it passes from the shoe of the hopper to the eye of the millstone, to traverse for a short space a highly heated current of steam, whereby the skin of the grain is at once softened and toughened without disturbing the texture of the body of the kernel. The consequence of this sudden superficial scalding is, that as the grain passes immediately between the millstones, the hull is at once rubbed by the stones clear from the body of the kernel; the bran remains in large flakes and is easily sifted out, the flour is completely detached from the bran and the yield in true flour is materially increased."

Claim.—"I claim in combination with a steam pipe and grain passage the deflecting partition for directing the steam upward and the grain downward, whereby the current of grain is steamed by direct contact with the current of steam at the moment before entering the mill, substantially as herein set forth."

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25. For an *Improvement in Balancing Sash;* Hiram C. Brown, Xenia, Greene county, Ohio, May 14.

The patentee says,—"The nature of my invention consists in so counter balancing window sash, that either may be raised or lowered by the same cord without running the other sash."

Claim.—"What I claim as my invention, is, 1st, in connexion, the grooves in the sash, the distribution in the several pulleys and friction wheels, and the cord attached to the bottoms of the sashes instead of their tops, whereby the cord and pulleys are kept entirely out of view; 2d, The combination of the barrel axle, ratchet wheel and pin, with its case or bearings, or their equivalents, with the cord and pulleys; the whole arranged and operating substantially as herein set forth."

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26. For a *Toothed Segment Lock for Fire Arms;* Dexter H. Chamberlain, Boston, Massachusetts, May 14.

Claim.—"What I claim as my invention, is the movable toothed segment and escapement or spring pawl, or any mechanical equivalent therefor, (the said segment and escapement being arranged within the trigger,) and the toothed segment or arc (of the hammer) in combination together, and with the trigger, hammer, and stock, and made to operate substantially in the manner as herein before specified.'

27. For a *Cylinder and Trough Gold Washer;* Thomas M. Collins, Marion, Crittenden county, Arkansas, May 14.

The patentee says,—"My improved gold washer is composed of a trough having a bottom made of raw hide, leather, or some fibrous manufacture, and a wheel placed within the said trough, having its periphery wound with rope or covered with some other fibrous material."

Claim.—"What I claim as my invention, is the separating gold or other heavy substances from others of less specific gravity and water with which it may be mingled, by the use of a wheel or cylinder and trough—the periphery of the former and the bottom of the latter being covered and constructed substantially in the manner set forth."

28. For a *Revolving Jaw Wrench;* Colver & Damrell, assignees of Nathaniel Colver, Boston, Massachusetts, May 14.

Claim.—"I claim the revolving jaw block, and feather, as combined together and with the screw shank, and made to operate substantially as specified."

29. For an *Improvement in Connecting Skeins with Axles;* Abel Combs, Farmington, Trumbull county, Ohio, May 14.

Claim.—"What I claim as my invention, is the combination of the skein with the screws for the purpose of tightening the skein on the axletree as set forth."

30. For an *Improvement in Preventing Fibres from Winding on Drawing Rollers in Spinning Machines;* John C. Dodge; Dodgeville, Bristol county, Massachusetts, May 14.

Claim.—"I do not claim as my invention the mere use of a roller under the front drawing, and turned by it in an opposite direction as the same has heretofore been applied and operated; but what I do claim, is the improved manner of applying and using the roller, the same consisting in placing it not exactly in contact with the lower front drawing roller, but at a distance therefrom, and by means of a separate or additional machinery, giving to it a rotary motion at the same velocity and in the same direction with those of the said lower front drawing roller; the whole being substantially in the manner and for the purpose as specified."

31. For an *Improvement in Machines for Washing Table Furniture;* Joel Houghton, Ogden, Monroe county, New York, May 14.

The patentee says,—"The nature of my invention consists in placing the crockery or other articles of table furniture in a machine fitted to receive them, and then to wash them by turning a shaft, with arms and buckets so arranged as to throw the water upon the crockery with force, and thus acting upon and cleaning each and every article."

Claim.—"What I claim as my invention, is the construction of a cylinder with a cylindrical rack supported by an upright shaft resting upon and being within and supported by the cylinder, the rack having within it a conical rack and hoop to receive and hold table furniture; in combination with a curb containing a horizontal wheel with buckets to throw water upon the cylindrical rack; the whole supported by a frame, and by these mechanical means cleansing the surface of table furniture without the use of hands—the entire machine being arranged, combined and operated, substantially as is herein fully set forth."

32. For an *Improvement in Cooking Stoves;* Jordan L. Mott, City of New York, May 14.

The patentee says,—"The first part of my invention relates to the mode of making the cover of the feeder which supplies the coal to the fire chamber, and which projects forward of the front plate, that it may answer the two fold purpose of supply door and damper, and when applied to parlor stoves admit of opening the front, as it is frequently necessary to admit a draught to the upper part of the feeder; and this part of my invention consists in making this door in two parts adapted to slide to and from each other in grooves made in or near the upper edge of the extended front constituting the feeder.

"The second part of my invention relates to a method of forming the bottom grate or a part thereof, by casting on to either the fire plate, front oven plate, or ash plate, projecting bars of the requisite size and at the proper distances apart to constitute a grate, whereby these not only become better conductors of heat, but also much expense is saved in the casting of the bottom grate.

"The third part of my invention relates to the making of fire brick for the lining of stoves by giving them more strength to resist breaking, and when cracked or split, to prevent them from separating; and this consists in combining them with iron rods or wires, by either moulding or baking them on metal rods or wires, or wire cloth, or moulding them with holes for the insertion of metal rods or wires.

"The fourth part of my invention relates to the increasing of the heat at the bottom of the oven, and consists in effecting this by means of two series of flue tubes at the bottom of the oven, one series above the other, and with sufficient space between the several tubes for the circulation and passage of the heat into the oven, the said series of tubes being so connected with each other and with the flues, that the gaseous products of the combustion shall pass either through both at the same time, or first through one series and return through the other.

"And the last part of my invention relates to the support of the oven or other doors of the stoves, and consists in combining with the door to be supported a brace rod jointed to the outside of the door, and passing through a hole or loop in some part of the stove below, so that when the door is let down the said rod shall act as a brace and support, and when the door is closed the said rod shall be close thereto."

Claim.—"What I claim as my invention, is, 1st, I claim making the cover of the feeder projecting in front with curved sliding doors, substantially as described.

"2d, I claim forming the bottom grate by casting projections from the edge of the fire back, or the equivalent thereof, substantially as described.

"3d, I claim giving the required strength to the fire brick lining of the stoves to prevent them from breaking or separating when cracked by the heat, by the insertion into them of metal rods, or wires, or wire cloth, substantially as described.

"4th, I claim the combination of the two series of flue tubes arranged one above the other, and with a space between them all for the circulation and radiation of heat, for the purpose of giving a greater heat at the bottom of the oven substantially as described; and this I also claim in combination with the above arrangement of flues as described.

"And lastly, I claim the method of supporting and bracing the door or doors by means of the bracing rod hinged to the door, and passing through a hole below (or the equivalent thereof) and bearing against the bottom of the stove, or a stop, or the equivalent thereof, substantially as described."

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33. For *Improvements in Splint Machines;* Horace Patterson, Templeton, Worcester county, Massachusetts, May 14.

Claim.—What I claim as my invention, is the combination of the circular or tube cutters, their lateral wing knives or cutters, their rib knives or cutters, and the waste escape passages for the waste strips, substantially in the manner and for the purpose as specified.

"I also claim the improvement by which I am enabled not only to make round or cylindrical splints, but to introduce them to the dipping frames; that is, I claim in combination with the cutters for forming the round splints and passages for receiving them and conducting them to the dipping frames, the passages for the escape of the waste wood or strips, the same being applied together and made to operate in connexion with the reducing plane iron and the plates, substantially as specified."

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34. For an *Improvement in Threshing Machines;* A. S. Pelton, Clinton, Middlesex county, Connecticut, May 14.

The patentee says,—"My improvements, although all of them have reference to one object, namely, the effective separation of the grain from the hull and straw, are of a two fold character, and consist, 1st, in such a form and arrangement of beaters as shall effectually expel the grain from the heads without dissevering the latter from their stalks, or allowing the latter to clog and thereby retard the action of the beaters; and 2dly, in the adaptability of the machine to different and varying actions on the grain, partly by the adjustability of the beaters and partly the mobility of the feeding apparatus."

Claim.—"What I claim as my invention, is, 1st, the peculiar serrated and duplex conformation of the beaters, substantially after the manner and for the objects herein described: that is to say, consisting of a pair of plates diverging rectangularly from each other, and the latter consisting of teeth chamferred off from the inner side at their points as represented."

35. For an *Improvement in Sewing Machines;* O. L. Reynolds, Dover, Strafford county, New Hampshire, May 14.

The patentee says,—"The nature of my invention consists in a new construction, combination and arrangement of the parts of a sewing machine, whereby the working parts are caused to perform their duties twice during each revolution of the main shaft, or first mover, and thereby form two stitches.

"Also in the use of a piercer worked by the same motion as the needle, for the purpose of perforating the cloth previous to making the stitch; also in the use of a guide or leader through which the thread is passed as it comes from the spool by which it is supplied; this guide has such a motion that each time the needle (which is of the form of the bearded stocking or knitting frame needle) is passed through the cloth, the thread is led over its point, so as to be caught and drawn back through the cloth at the backward motion of the needle; also in the manner of holding the cloth to be operated upon."

Claim.—"What I claim as new, is, 1st, the adaptation of the bearded needle, such as is used in knitting or stocking frames, in combination with the manner of closing the beard or hook thereof, previous to drawing it back with the thread to prevent the point tearing the cloth, by passing it through the hole in the plate in the manner substantially as described.

"2d, The combination of the spring thread leader or guide, the arched spring, and the friction roller, for the purpose of leading the thread under the point of the beard of the needle."

36. For an *Improvement in Suspender Buckles;* William Scarlett, Newark, New Jersey, May 14.

Claim.—"What I claim as my invention, is the constructing a buckle by combining a curved plate with an angular lever, substantially in the manner set forth."

37. For a *Shell Propeller;* James Trees, Salem, Westmoreland county, Pennsylvania May 14.

The patentee says,—"My invention is based on the voluted form of certain sea shells, which have a single cell twisted helically around a central axis of which class of shells that represented in the drawing is a type."

Claim.—"What I claim as new, is giving the shell of a submerged propeller the form of a section cut from the open extremity of sea shells, of the class of which that represented in the drawing may be considered a type, the mouth of the helical tube at which the water enters being of greater area than its hinder extremity at which the water is discharged."

38. For an *Improvement in the Joints of Stove Pipes;* James N. Warner, Buffalo, New York, May 14.

The patentee says,—"My invention consists of a pipe composed of lengths, upon each extremity of which a worm is swaged; when the pipe is to be put up, the worms of one length are entered by turning into those of the next ones, thus securing the whole together and forming a continuous pipe which cannot be accidentally disconnected."

Claim.—"What I claim as my invention, is the stove pipe herein described as a new article of manufacture."

39. For an *Improvement in Machine for Polishing Raw Hide Whips;* Charles Baeder, City of New York, May 21.

Claim.—"What I claim as my invention, is the before described method of grinding, smoothing, and polishing raw hide whips, in the manner and for the purpose herein fully set forth: that is to say, by the combination of the endless revolving belts, between which the rough raw hide whip is placed, the suspended frame containing the upper endless belt being arranged and operated in the manner and for the purpose set forth."

40. For an *Improved Arch Girder;* John Bevan, City of New York, May 21.

The patentee says,—"The first part of my invention consists in strengthening an arched girder or beam, and distributing the weight applied to or passing over it, by means of a metal strap, chain, or wire rope, which constitutes the chord, and which passes around the ends and over the entire length of the upper surface of the arch, whereby the arch is bound from end to end by the said metal strap, chain, or wire rope, to prevent it from spreading lengthwise; any tendency to elongate the chord having the effect to draw the said metal strap, chain, or wire rope down on to the upper surface of the arch, and thus to distribute any weight or pressure applied at any one point over the entire line of the arch.

"The second part of my invention consists in providing the arched beam or girder with rollers at the ends, when this is combined with the metal strap, chain, or rope, provided with a tightening screw or coupling for the purpose of regulating the length thereof, to adapt it to the changes of temperature, and to camber the beam or girder."

Claim.—"What I claim as my invention, is the method substantially as above described, of strengthening arches by means of metal straps, chains, or ropes, which constitute the chords, and pass around the ends and over the arched surfaces thereof, without being attached thereto, substantially in the manner and for the purpose specified.

"And I also claim providing the arch or beam with rollers at the ends, around which the strap, chain, or rope passes, substantially as described, when this is combined with a coupling or tightening screw for varying the length of the said strap, chain, or rope, substantially in the manner and for the purpose specified."

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41. For an *Improvement in Machines for Drying Bagasse;* James H. Dakin, Baton Rouge, Louisiana, May 21.

Claim.—"What I claim as my invention, is the employment of a revolving or rotary inclined flue, as applied and used for drying the bagasse or compressed sugar cane, or any other green or wet substance intended for fuel, with the heat and flame coming from the furnace under the sugar kettles, or from any furnace whatever, all passing into or through this said inclined or rotary flue at one and the same time, causing thereby the said bagasse or compressed sugar cane, or other said substance intended for fuel, to become dry and combustible, and prepared for fuel, the moment that it has passed through said flue, using such machinery or mechanical means as I have herein described, or any other suitable mechanical agency or means that will enable me to carry out and put into practical execution or use the principle or principles herein set forth, described, and claimed, and to obtain the intended objects and results in combination as a whole."

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42. For an *Arrangement and Connexion of Screw Propellers;* Patrick S. Devlan, Reading, Berks county, Pennsylvania, May 21.

The patentee says,—"My propelling apparatus is composed of a principal and one or more supplementary propellers, suitably secured at the stern of the vessel, connected together by cog wheels, and enclosed in a chamber, the hinder side of which is open to the water. Water is supplied to the front side of the propeller chamber by pipes which pass through the vessel and deliver it to a water chamber immediately in front of the propeller chamber, and communicating with it by circular apertures in which the smaller propellers are placed."

Claim.—"What I claim as my invention, is the arrangement of the principal and auxiliary propellers connected by cog gearing or its equivalent with that of the water pipes, in the manner and for the purposes substantially as herein set forth."

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43. For an *Improvement in Harness Buckles;* Jacob S. Embich, Green Village, Franklin county, Pennsylvania, May 21.

The patentee says,—"My buckle consists of a plate of metal which is secured at one extremity to one strap, and is furnished at its opposite extremitiy with a bridge or staple beneath which the other strap is passed; a second plate is hinged fast to this bridge, and is furnished with two pins for holding the strap, (in place of the tongue of the common buckle,) which, when the plate is brought down upon the leather strap laying against the fixed plate, pass through holes made in the strap, and enter holes made in the fixed plate, thus preventing the strap from being drawn from between the two plates; one of the pins is constructed with a hooked extremity, which, springing into a recess made for the purpose, prevents the plate to which the pins are secured from being accidently withdrawn from the fixed plate."

Claim.—"What I claim as my invention, is a buckle constructed substantially as herein set forth, of a fixed plate and of a movable plate, between which the strap is retained by pins secured to the one plate and engaging in the other."

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44. For *Improvements in Hand Looms;* John G. Garretson, Salem, Henry county, Indiana, May 21.

The patentee says,—"My improvements in looms chiefly consist in the novel method of shedding the web by the direct action of the lathes upon the treadle, by means of the finger, at each backward vibration of the lathe, coming in contact with a shoulder or jog on the treddle provided for that purpose, together with machinery attached to, and in, the body of the lathe, suitable for moving the finger successively from treddle to treddle, such as the nature of the fabric may require; also machinery suitable for propelling the shuttle back and forth immediately after the shed is produced."

Claim.—"What I claim as my invention, is the shedding the web by the direct action of the lathe on the treddles, by means of the movable finger and the finger-staff, or any similar fixtures for the purpose, bearing down the treddle, and thereby producing a shed in the web at the backward vibration of the lathe.

"I also claim as my invention the combined action of the hand, cam wheel, finger-staff, and the finger, upon the treddles, as above described, for the purpose of shedding the web by the backward vibration of the lathe.

"I also claim the combined action of the hand, cam wheel by the zig-zag groove, lifting slide, and drivers upon the picker staff, as above described, for the purpose of throwing the shuttle back and forth alternately at each backwark vibration of the lathe, immediately after the shed is produced, the loom to be propelled by hand or other suitable power; all the above parts being substantially as herein described."

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45. For *Improved Wickets for Lock-Gates;* Alfred Bell, assignee of John Jack, Nunda, Livingston county, New York, May 21.

Claim.—"What I claim as my invention, is making and arranging a sliding wicket gate in such a manner that when shut it shall rest upon its seat and make a tight joint, but when moving to or from its closed position, shall be raised from its seat and supported on wheels to diminish the friction, and, consequently, the expenditure of power required to open or close it; the power for operating it being applied through a lever, or its equivalent, so as to move the gate very slowly, but with great force, until it is started from its seat, and the weight thrown upon the friction wheels, and then to act upon it with diminished force, but move it faster, until it is fully open; thus counterbalancing as near as may be the force and the resistance.

"I do not claim the mere counterbalancing of the weight of the gate and the pressure of the water on its upper edge, by means of the pressure of the water acting upon a flange at its lower edge; but what I do claim, is placing a flange for this purpose in an inclined position, substantially as described, so that the vena contracta shall not prevent the issuing water from pressing against it."

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46. For an *Improvement in Machinery for Sawing Staves;* Edwin Jenney, New Bedford, Bristol county, Massachusetts, May 21.

Claim.—"What I claim is the mode of steadying a long cylinder saw, viz., by means of a shaft and proper connexions at one end of the saw, in combination with a series of friction rollers and their supporting frame, applied outside of the saw and made to bear against the curved surface of the same, and at or near its other or serrated end, substantially as explained."

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47. For *Improvements in Machines for Sawing Wood;* Spencer Lewis, Tiffin, Seneca county, Ohio, May 21.

The patentee says,—"The distinguishing characteristic of my invention consists in reducing and alleviating the laborious business of sawing fuel wood into short cuts suitable for burning in stoves, &c., by the combination and arrangement of certain mechanical devices with a reciprocating saw, by which the wood to be cut is held firmly between self clamping hinged jaws—the descent of the swinging sash (after the wood has been cut) serving to advance a horizontal suspended lever in a position to be struck and lifted by a rotating lifting arm fixed to a horizontal transverse shaft, and elevate the swinging sash over a spring catch, and at the same time raise the feeding lever through the agency of a transverse bent lifting arm, to be actuated by a forked arm on the transverse shaft, to operate a jointed reaching arm, to move the slide bar and wood in a position for another cut, by simply continuing to turn the crank handle."

Claim.—"What I claim as my invention, is, 1st, the combination and arrangement of the suspended vibrating feeding lever, and rotating forked arm, jointed reaching arm, rack and slide bar, with the self clamping self adjustive hinged jaws for holding the wood firmly during the operation of sawing—the feeding of the log being effected by means of the forked arm actuating the feeding lever in the manner described and represented.

"2d, I also claim the combination and arrangement of the suspended lifting lever and the rotating lifting arm on the shaft, with the swinging sash as described—by which the descent of the swinging sash will cause the lever to advance toward the rotating lifting arm when the wood is cut—and thus elevate the swinging sash in the manner and for the purpose herein set forth.

"3d, I likewise claim the combination of the transverse bent lifting arm, and suspended lifting lever, with the suspended feeding lever,—bent rod for unlocking the spring dog, and vertical spring catch, as described, by which the feeding lever is engaged with the jointed reaching arm, simultaneously with the ascent of the swinging sash in the manner and for the purpose set forth."

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48. For *Devices for Discharging Ashes from Tuyeres;* James A. Maynard, Boston, Massachusetts, May 21.

Claim.—"What I claim is combining with the valve on the end of the discharge pipe, a scraper, substantially as described, so that the opening of the valve by the stopping of the blast shall cause the scraper to act substantially in the manner and for the purpose specified."

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49. For a *Method of Giving Rotary Motion to Fluid Iron in Casting Rolls;* John C. Parry, Pittsburgh, Pennsylvania, May 21.

The patentee says,—"My invention consists in a new and useful mode of communicating the requisite rotary or swirling motion to the melted metal, which I effect by means of a paddle or fan which is fixed and attached to the rod in the mould as described. This paddle is caused to revolve by turning the crank, carrying the wheel which moves the rod to which the paddle is attached. The paddle turns round in the lower journal, and the melted metal entering the mould in the lower coupling, meets the paddle as it rises in the mould, and by the action of the vanes turning round in the rising metal, produces a complete swirl or rotary motion which continues until the roll is cast."

Claim.—"What I claim as my invention, is the combination of the paddle or fan with the rod *i* and rod *r*, and the frame work and gearing for giving motion to the fan, for the purpose of producing the rotary motion of the iron in casting chilled rolls and similar castings."

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50. For an *Improvement in Feed Regulator for Canals;* Charles Ross, West Buddick, Van Wart county, Ohio, May 21.

The patentee says,—"The use to which this invention is applicable, is to so regulate by a self adjusting principle, the supply of water to mills or canals, that they may not be subject to a dangerous or inconvenient redundance (except in times of freshets) nor a deficiency when a supply may be obtained."

Claim.—"What I claim as my invention, is the combination of the box, the float L, sliding valve, segment gate, and float Z, arranged and connected with the mechanism, whereby they have a united action in the manner and for the purpose herein described."

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51. For an *Improvement in the Form of Rubbing Surfaces for Regulating Abrosion;* Christian Schiele, Frankfort, Germany, May 21; anté, dated November 23, 1848.

The patentee says,—"The nature of my invention consists in the application of a certain curved form to the construction of cocks or valves, pivots, millstones, or similar parts of machinery in general, (where the rubbing surfaces have to bear a pressure in the direction of their axes,) in order to lessen the friction or to regulate the wear of their rubbing surfaces."

Claim.—"What I claim as my invention, is the application of the curved form above described to the rubbing surfaces of cocks or valves, pivots of upright shafts, millstones, or other parts of machinery in general where the rubbing surfaces have to bear a pressure in the direction of their axes."

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52. For *Improvements in Attachments to Mills for Preparing Corn in the Cob for Grinding;* John M. Seely and William E. Tomlinson, Lockport, Warren county, Ohio, May 21.

The patentees say,—"The nature of our invention consists in attaching a cylindrical block or bush, by a recess or other device, to the balance ring in the eye of the runner of a pair of burr or other millstones, the said block having inclined faces leading to throats opening beneath knives adjusted thereto, and the said throats winding around the periphery of the block and delivering themselves into the eye of the runner, so that ears of corn thrust into tubes of a size suitable therefor, in the body of a feeder or cap, will come in contact with the rotated knives, and be minutely cut up and fed to the millstones; the said tubular feeder or cap being either appropriately held or made stationary for that purpose, and the tubes therein being at a distance apart equal to that of the diametric distance of the knives apart."

Claim.—"What we claim as new, is the block, with its arrangement of inclined planes, knives, throats, and other devices, which adapt it to operate on corn cobs or ears of corn received from a suitable feeder, and also to be inserted in the eye and be driven by the irons of the runner stone of grinding mills, substantially in the manner and for the purpose described.

"We also claim the block, arranged as described, in combination with the tubular feeder, arranged substantially in the manner represented, and for the purpose described."

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53. For *Improvements in Power Looms;* John Shuttleworth, Frankford, Philadelphia county, Pennsylvania, May 21.

The patentee says,—"One part of my invention consists in combining the advantages incident to rising and falling heddles with those peculiar to the 'cylindrical jacquard:' that is to say, the formation of the shed in the warp is effected by a descending as well as an ascending motion of the heddles, and thus is avoided the unequal tension, and consequent liability of the warp to stretch and snap, which takes place in all cylindrical jacquards known to me.

"Another part of my invention consists in arrangements of structure in the cylindrical jacquard, to facilitate adjustment to the pattern, so as to enable the weaver to accomplish in a few minutes what is usually the work of hours.

"Another part of my invention consists in the arrangement of mechanism by which is effected the intermittent and gradual rotation of the cylinder.

"Another part of my invention consists in improvements on the mechanism for operating the picker staffs."

Claim.—"What I claim as new, is, 1st, the imparting to the heddle bearer a motion simultaneous with, and in opposite direction to, the vertical one of the cylindrical jacquard, by an arrangement of supplementary levers and their appendages as herein described, or by mechanism substantially equivalent, the scroll cam or split pulley being so arranged as to act alternately as a lock and guide, and as a cam.

"2d, The arrangement and combination, substantially as described, of a segmental shell and stoppers for the ready adjustment of the jacquard to the pattern."

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54. For a *Machine for Grinding Spiral Knives;* George Forbes, assignee of Silas Stevens, East Brookfield, Worcester county, Massachusetts, May 21.

Claim.—"What I claim as my invention, is the employment and use of the radial arm and its pivots or contrivances for supporting the knife, substantially in the manner, and connected with the other parts of the mechanism, as specified."

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55. For an *Improvement in Apparatus for Setting Logs in Saw Mills;* Thos. C. Theaker, Mansfield, Richland county, Ohio, May 21.

The patentee says,—"The nature of my invention and improvement consists in combining with the common hand-setting lever an alternate revolving cylinder, and sliding dog placed eccentrically to the centre of the cylinder, so that it can be changed to either of two circles of teeth on the face of the ratchet wheel, whose cogs incline in opposite directions, by which the motions of the ratchet wheel can be changed by the use of one dog only and one lever."

Claim.—"What I claim, is the combination of the alternating cylinder, eccentric sliding dog, cog, notch, and sliding spring, with the common vibrating hand lever, and concentric circles of teeth inclining in opposite directions, for turning the ratchet wheel, on the end of the pinion axle, to the right or to the left, for moving the log on the head or tail block, either to the right or left, toward or from the saw, as specified."

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56. For an *Improvement in Lathes for Turning;* J. D. White, Hartford, Connecticut, May 21.

The patentee says,—"The nature of my invention consists in providing what I call a 'movable way,' on which the tool stock slides, and by which it is guided, the said way being constructed with one end secured by a permanent pivot or vertical axis joint to the lathe table, and the other end of the said way constructed with a slot in it, through which passes a set screw to hold that end of the way to the table, and also to allow that end of the way to be moved out and in, to and from the revolving axle on the lathe, so that when the tool stock is moving along on the slide with the tool in contact with the axle to be turned, the said movable way will so guide the cutting tool as to turn any axle or shaft of a tapering form; and also, by the said movable way being set parallel with the revolving axis to be turned, the cutting tool will be thereby enabled to turn journals or shafts of an equal diameter throughout.

"My invention further consists in providing two such movable ways to one lathe, and arranging the driving gearing at and on the middle of the lathe, having two head stocks and a chuck on the middle of the lathe, so that two cutters may be turning the different ends of a railroad car axle at one time, the one cutter turning the taper while the other is turning the journal of the axle at the other, which requires the operator's undivided attention.

"My invention further consists in providing an opening in the chuck, head stock, and chuck spur wheel, whereby the axle can be placed in and taken out of the chuck at the side instead of endways."

Claim.—"I claim the central stock heads, and the chuck, and the large spur wheel, with the slots in them, to allow the axle to be placed in and taken out of the chuck sideways; the large spur wheel being driven by spur wheels Q G S, and T T, the one T acting as a compensation gearing to the other, while the slot of the large spur wheel is passing the other spur wheel T, in the manner substantially as set forth."

57. For an *Improvement in Quilting Frames;* William T. Barnes, Buffalo, New York, May 28.

The patentee says,—"The nature of my invention consists in a combination of standards, cross bars, or rollers, check rods or stays, screws and bands, so constructed that, by using them as described, fabrics can be quilted more beautifully and with greater facility than by the common mode."

Claim.—"I claim the folding and rolling the layers of any fabric (which it may be desirable to quilt) verily by the use of check rods attached to rollers as described; the rollers, when operating, made to revolve alternately till the fabrics are folded and strained to the desired tension and position."

58. For *Improvements in Apparatus for Jointing Slats, Boards, &c.;* Alanson Blanchard, West Cambridge, Middlesex county, Massachusetts, May 28.

The patentee says,—"The object of this machine is to enable carpenters to reduce with great facility and little care, blind stuff, stair threads, or various other boards, to equal or unequal widths."

Claim.—"What I claim as my invention, is the combination of the frame with its supporting rails, the adjustable support or bed bar, its supporting and elevating screws and contrivances, and the movable clamping bars with their clamp screw mechanism; the whole being applied and made to operate together, and in connexion with the plane, substantially as specified."

59. For an *Improvement in Making the Reservoirs of Metallic Lamps;* P. J. Clark, Meriden, New Haven county, Connecticut, May 28.

The patentee says,—"The nature of my improvement consists in forming the feeders of lamps, having their reservoirs made of tin or other sheet metal, of the same piece of metal which forms the sides of the reservoir, whereby I am enabled to construct the lamps cheaper and render them more durable, as only one solder joint is necessary: that is the joint or seam up the side of the reservoir."

Claim.—"What I claim as new in my invention, is making the shell of the lamp reservoir, with the feeder standing out from one side, of one single plate of metal, so as to require only one seam or solder joint, in the manner substantially as described."

60. For an *Improvement in Galvanic Registers for Steam Boilers;* Arthur Dunn, Dalston, Middlesex county, England, May 28; anté dated October 12, 1848.

The patentee says,—"My invention consists in so combining and applying thermometric apparatus and electric currents as to ascertain the temperature and pressure of fluids in vessels, principally applicable to steam and other boilers.

"My invention also consists of combining electric apparatus with pressure gauges, in such manner as to ascertain and indicate when the pressure of a fluid arrives at a determined point."

Claim.—"What I claim is a galvanic battery or generator of electricity, and its current wires or conductors, an alarm or bell apparatus, and a mercurial column tube combined with a steam boiler, and made to operate substantially in the manner and for the purpose of indicating the temperature or pressure of steam in the boiler as specified."

61. For an *Improvement in Apparatus for Jointing Boards;* David Foster, Whitestown, Oneida county, New York, May 28.

Claim.—"What I claim as my invention, is the combination of the grooved plane with the guides, the sliding posts and adjusting screws arranged in the manner and for the purpose described."

62. For an *Improvement in Smut Machines;* Cyrus D. Gordon, West Martinsburg, and Samuel S. Gouldthrite, Lowville, Lewis county, New York, May 28.

The patentees say,—"The nature of our invention consists in scouring wheat or other grain between two plates having waved and fluted surfaces. One of these plates is stationary, and forms the upper plate of the outer casing of the machine, and the other plate forms the head of a revolving drum.

"The plates may be adjusted at any distance apart, according to the nature or size of the grain, so as to break the smut balls and separate the dirt from the grain without breaking or bruising the grain. The smut, dirt, &c., is carried off through apertures in the outer casing by a current of air, which is caused to circulate through the machine by means of the revolving drum. The vertical shaft on which the revolving drum is mounted, is provided with a cup into which the grain is fed, passing through apertures in its lower part on to the plate of the revolving cylinder; by feeding from the centre, we are enabled to use the entire working surface of the plates, and to take the grain from any direction in the room without moving the machine."

Claim.—"What we claim as new, is, 1st, the combination of the cup with the shaft, for the purpose of receiving the grain and conducting it all around between the plates, as described.

"2d, The adjustable bearing or guide for setting the shaft vertical, consisting of the box with the blocks and the screws, constructed and arranged as set forth.

"3d, The circular revolving winged and slotted drum in combination with the scouring plates, in the manner substantially as described, producing a current of air for carrying off the smut, dirt, and other foreign matter."

63. For an *Improvement in Machinery for Making Copper Tubes;* Edward Hamilton, Bridgeport, Fairfield county, Connecticut, May 28.

Claim.—"What I claim as my invention, is the employment of the horizontal heat retaining conducting tubes, in combination with the grooved rollers, arranged and operating in the manner and for the purpose set forth."

64. For an *Improvement in Machinery for Making Four Sided Buckles;* Alvin North, Oliver B. North and Stephen Frink, New Britain, Hartford county, Connecticut, May 28.

Claim.—"What we claim as our invention, is, 1st, the combination of the vibrating carriage, (in which is placed the die,) the toggle lever, or benders, the gauge bars, detacher, holders, and cutting lever; the whole constructed and operating substantially as described, and by means of which a four sided buckle is formed.

"2d, The combination of the sliding frame and the vibrating hook, with the grooved die and the fly punch, the whole constructed and arranged substantially as described.

"3d, The combination of the vibrating jaws, the cam and levers with the forming block and rod, and sliding bar, the whole constructed, arranged and acting substantially as described."

65. For an *Improvement in Processes for Preserving Wood;* Charles Payne, South Lambeth, Surrey county, England, May 28; anté, dated January 9, 1842.

The patentee says,—"My invention relates to a mode of preserving vegetable matters by causing them to be impregnated with solutions of metallic or earthy matters, and then by chemical decomposition to obtain the preserving matters employed in an insoluble state within the substance of the vegetable matter, treated when such effects are obtained by the combined processes of exhaustion, pressure, and chemical decomposition; my invention relating to a *mode* of *applying* such matters, and not to the use or application of such preservative matters generally."

Claim.—"What I claim as my invention, is the combination of the processes of immersion, absorption, exhaustion, pressure and decomposition, substantially in the manner and for the purposes as explained."

66. For an *Improvement in Fanning Mills;* Jesse Roberts, Penn's Square Post Office, Montgomery county, Pennsylvania, May 28.

Claim.—"What I claim as my invention, is the employment of the racks, perforated gauge plates, hooks and confining rods, in combination with the shoe for confining and adjusting the riddles and screen in the shoe, in the manner described.

"I also claim the arrangement of the vibrating longitudinal inclined conducting trough, in combination with the transverse inclined conducting trough attached to the vibrating shoe for receiving the cleaned grain from the screen, and conducting it directly to the measure or bag, as described."

67. For an *Improvement in Water Backs for Cooking Ranges;* Herbert H. and Frederick H. Stimpson, Boston, Massachusetts, May 28.

The patentees say,—"Our invention consists in providing a means of preventing the pipes and back from choking with sediment, and insuring a ready flow of the water throughout by casting the pipes on to the hollow back, each with a convergence towards the other, when the inside of the top and bottom of the hollow back converge with the same angle, and coincide respectively with the induction and eduction pipes, whereby air is prevented from collecting in the hollow back over the water and producing the snapping noise so often heard in such backs, and whereby, also, a ready flow of water is secured."

Claim.—"What we claim as our invention, is casting the induction and eduction pipes of the hollow back of cooking ranges, each with a convergence towards the other, when the lines of the inside of the top and bottom of the hollow back converge with the same angle, and coincide respectively with the lines of the induction and eduction pipes for the purpose and in the manner described.

"We also claim constructing the hollow back itself with the lines of the inside of the top and bottom, converging towards each other for the purpose of preventing the accumulation of air and securing a ready flow of water as described."

68. For an *Improvement in Tailors' Measures;* Amos Stocker, Ogdensburgh, St. Lawrence county, New York, May 28.

The patentee says,—"The nature of my invention consists in providing a means for taking measures, which are used to form the fore part and backs of garments, to fit the forms of persons for whom they are intended."

Claim.—"What I claim as my invention, is the instrument as represented at Fig. 3, for ascertaining the slope of the shoulder, also the instrument represented at Fig. 2 for ascertaining the measure from the socket bone to a line perpendicular to the most prominent parts of the back, substantially as described, and for the purposes set forth in the specification."

69. For *Improvements in the Preparation of Pile for Rugs, &c.;* John, Joseph and Francis Crossley, assignees of James Taylor, Loch Winnoch, Renfrew county, Scotland, May 28; ante, dated October 10, 1845.

The patentees say,—"Our improvements in the manufacture of carpet rugs and other piled fabrics, refer to that class of fabric which is produced by cementing the pile to strong cloth (which forms the back of such fabrics) by means of India rubber or other suitable adhesive substance: the difficulty experienced in arranging the lengths of wool or worsted yarn used in this manufacture to form the pile so that their ends shall form any desired pattern, has long prevented the successful working of this method of producing piled fabrics;

but by my improvement, I am enabled to lay down given lengths of differently colored yarn in such quantities as will admit of any required pattern being copied with precision and rapidity."

Claim.—"What I claim is the mode or process described of combining or arranging together, and in the pile, the threads or yarns composing the figure or figures, the same consisting in winding the said threads on a beam or roller by the aid of a collar, pattern, and index, and other contrivances essentially as specified, and cutting the said threads and transferring them on, and by means of the roller to the pile in the machine in which they are compressed, cemented and cut, all as explained."

70. For an *Improvement in Sofa Bedsteads;* A. G. Warren, Norwich, New London county, Connecticut, May 28.

Claim.—"What I claim as new, is, 1st, the drawer with castors made so as to serve the double purpose of a receptacle for the bedclothes and a support for the back, as described."

"2d, I claim the sliding head and foot boards so connected with the back that they slide in or out, as the back is raised or lowered by the contrivances as above described, or other equivalent devices."

71. For an *Improvement in Fanning Mills;* John Weidman, Littlestown, Adams county, Pennsylvania, May 28.

The patentee says,—"The nature of my invention consists of an improved construction and arrangement for operating the sieves in a winnowing mill, by which the shaking operation is more effectually accomplished, and thereby more grain is cleaned, and better cleaned, in the same time, than by any of the known modes,—and an improved adjustable tail board for separating the grain and chaff."

Claim.—"What I claim as my invention, is my improved construction and arrangement for shaking and operating the sieves in a winnowing mill, in the manner described."

72. For an *Improvement in Electro-Chemical Telegraphs;* C. Westbrook, Washington, D. C., and Henry J. Rogers, Baltimore, Maryland, May 28.

The patentees say,—"The nature of our invention consists in recording telegraphic signs on a metallic surface, connected with the earth by a wire conductor at one end, and to a galvanic battery and the earth at the other end of the circuit, by the use of acidulated water, or other fluid, interposed between the point of the usual wire conductor leading from the operating apparatus, connected with a galvanic battery, of the ordinary construction, and the metallic surface, by which the use of paper is dispensed with; time also being saved in not having to moisten the chemically prepared paper when it becomes too dry for use, and in having the telegraphic signs more clear and distinct on the metallic surface than on the paper; and in avoiding the inconvenience arising from the fumes from the chemicals employed in preparing the paper, and evils arising from the corrosion of instruments—and annoyance to the operators in preparing and using chemical paper, and other inconveniences."

Claim.—"What we claim is recording telegraphic signs on the surface of a revolving metallic cylinder plate, or other equivalent surface, by means of an acidulated liquid or saline solution, or water, held between the point of the wire conductor and the metallic recording surface, by means of a non-conducting porous substance contained in a glass, or other non-conducting reservoir, in which the recording fluid is contained, to which the electric current from a battery is applied by means of any of the known forms of manipulators and anvils used for making and breaking the circuit—the recording fluid being applied to the metallic recording surface substantially in the manner herein fully set forth, by which the use of every description of paper is dispensed with, thereby saving great expense in telegraphing."

73. For *Improvements in Machines for Shearing Cloth;* Amasa Woolson, Springfield, Windsor county, Vermont, May 28.

The patentee says,—"My improved machine belongs to that class or species of shearing machines which shears the cloth from end to end; and if the two ends be joined, it may be passed through the machine any desired number of times without stopping.

"Its peculiar characteristic is in the 'rest' against which the shearing knives cut. This 'rest' has heretofore been made in one piece, and so as to be moved laterally by the hand of the operative who superintends the working of the machine, in order to provide for the swaying of the cloth from one to the other side of the machine. The object of my improvements is to provide a movable or changeable rest on each side of the stationary rest over against which the knives bear or draw, to remove or shear the nap; so that if the cloth in being fed along to the knives should be swayed to one side or the other of the machine, the rest will be extended or shortened accordingly, and the cloth will still be shorn close to the selvage and yet leave the requisite width of selvage on each side."

Claim.—"What I claim as my invention, is, 1st, a flexible rest, constructed substantially as described.

"2d, Making the rest susceptible of extension on each or either end by combining with the ordinary stationary rest, and on each side thereof a flexible and movable rest, as herein above specified.

"Lastly, I claim making an extension or flexible and movable rest, self-operating, or so as to be changed by the cloth itself in its passage through the machine; all as herein above set forth."

Re-Issue for May, 1850.

1. For an *Improvement in the Method of Rendering Lard;* Ebenezer Wilson, Cincinnati, Ohio, patented October 9, 1844; re-issued May 7, 1850.

The patentee says,—"The nature of my invention in the apparatus for extracting and rendering lard, &c., by the action of steam under high pressure, consists in combining with a steam tight tank provided with a perforated steam pipe for the admission of high pressure steam, and with a large discharge boiler and cover for the discharge of the residuum, a perforated false bottom above the perforated steam pipe, which perforated false bottom is to sustain the charge under the pressure and weight, and thus admit of the equal distribution and passage of the steam through the charge, and also to admit of the free and equal passage of the water of condensation.

"The nature of my invention also consists in combining with the said tank one or more try cocks near the top, and a regulating discharge cock at or near the bottom, for the purpose of discharging the water of condensation during the progress of the process, whenever, by the use of the try cock, the attendant ascertains that the tank is too full of water of condensation, and thus by these means insuring the free passage of steam through the charge.

"And the nature of my invention also consists in combining with the said tank a series of discharge cocks, arranged one above another for the purpose of drawing off the rendered lard, &c., as it floats on the water of condensation, and the foreign substances which by reason of their greater specific gravity will be found below."

Claim.—"What I claim as my invention in the above described apparatus for extracting or rendering lard, &c., by the action of high pressure steam, is combining with a steam tight tank, substantially such as herein described, and provided with one or more discharge holes for the discharge of the residuum, and with a perforated steam pipe at bottom for the introduction of high pressure steam, a perforated false bottom above the steam pipe to sustain the charge under the weight and pressure, substantially as described, to admit of and insure the free passage of the steam through the charge, and also the free descent of the water of condensation as described.

"I claim also, in combination with the tank substantially such as herein described, the employment of one or more try cocks near the top thereof, and a regulating discharge cock at or near the bottom, substantially as herein described, for the purpose of ascertaining when too much water of condensation has accumulated, and to discharge the same; to retain a sufficient space above for steam; to insure the passage of steam through the charge, as described.

"And finally, I claim, in combination with a tank substantially such as herein described, and for the purpose specified, the employment of a series of discharge cocks arranged at different levels, substantially as described, for the purpose of drawing off the rendered lard, &c., as it floats on the water of condensation, and thus insure the separation of the pure lard, &c., from all foreign substances, when this is combined with the relief or discharge cock, substantially as described."

2. For an *Improvement in Pumps;* Birdsill Holly, Seneca Falls, Seneca county, New York; patented June 5, 1849, re-issued May 7, 1850.

Claim.—"What I claim as my invention, is the combination of the nozzle with the pump barrel in such a manner that the nozzle can be readily changed from side to side, and secured in any desired position, substantially as herein described.

"I also claim the manner of connecting the induction pipe, the valve and its seat, with the base of the pump, without the aid of rivets or solder, and in such a manner that, when the base of the pump has been securely fastened to a platform, the respective parts of the pump, as also the induction pipe, can be combined with the base, or detached therefrom without disturbing its fastenings;—to wit: by means of the cup rising from the centre of the base, which has a screw cut in its inner periphery and a hole in the centre of its bottom, through which hole the induction pipe is inserted and enlarged by a mandrel; the metallic disk placed within the said cup, with the tube descending therefrom, inserted into the upper end of the induction pipe, the leather disk from the centre of which the valve is cut, placed on the disk; and the whole securely combined with each other by inserting the screw formed in the outer periphery of the lower end of the pump barrel, within the screw thread formed in the inner periphery of the base cup, and turning the pump barrel until the lower end thereof forces the above enumerated parts into the position represented in Fig. 2."

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3. For an *Improvement in Feeders for Screw Machines;* Solyman Merrick, Springfield, Hampden county, Massachusetts; patented March 7, 1846, re-issued May 7, 1850.

The patentee says,—"The principle or character which distinguishes my invention from all other things before known consists, 1st, in arranging screw blanks, pins and other like or similarly headed articles, so as to present them with the points or heads all in the same direction by oppositely inclined beveled or curved surfaces, with sufficient space between them to receive freely the shanks of such articles, whilst they hang suspended by their heads, operated essentially in the manner hereinafter described.

"2d, In making one of the said inclined beveled or curved surfaces in two parts, one above the other, to aid in giving to the screw blanks or other articles the required tendency towards the space between the said surfaces.

"3d, In combining with the said oppositely inclined beveled or curved surfaces, a fence or guard plate placed across from one to the other, and over the space in which the screw blanks or other articles are suspended, to prevent the passage of any which may not be properly suspended.

"4th, In combining with the oppositely inclined beveled or curved surfaces revolving arms, wings or beaters, to knock or beat back the surplus screw blanks or other articles, and prevent any but such as are properly suspended from passing towards the point of delivery.

"And lastly, In combining with the said oppositely inclined and moving surfaces a checking and delivering apparatus, to deliver out in succession the screw blanks or other articles."

Claim.—"What I claim as my invention, is, 1st, the method substantially as described of arranging screw blanks, &c., by the motion of oppositely inclined beveled or curved surfaces, with sufficient space between them to receive freely the shanks of the blanks whilst they hang suspended by their heads, the said motion of such surfaces being in the direction of the space between them, substantially as described.

"2d, Making one of the said inclined beveled or curved surfaces in two parts, one above the other, substantially in the manner and for the pupose specified.

"3d, Combining with the said oppositely inclined beveled or curved surfaces, a fence or guard plate placed across from the one towards the other, and over the space in which the blanks are suspended, substantially in the manner and for the purpose specified.

"4th, In combining with oppositely inclined beveled or curved surfaces, revolving arms, wings or beaters, substantially in the manner and for the purpose specified.

"And lastly, In combining with the said oppositely inclined beveled or curved surfaces, a checking and delivering apparatus, substantially in the manner and for the purpose specified."

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4. For an *Improvement in Planing Machines;* William Emmons, administrator of Calvin Emmons, deceased, City of New York; patented June 27, 1848, re-issued May 21, 1850.

The patentee says,—"The nature of my invention consists in the construction and combinations of the several parts as hereinafter described."

Claim.—"What I claim as my invention, is, 1st, the combination of the lever frame, cam wheel, and plane stock, substantially in the manner described; by means of which combination and the configuration of the cam wheels substantially as specified, and the plane stock which is made to move in a different and lower line during its forward stroke, than during its backward stroke, in the manner and for the purposes described.

"2d, The combination and arrangement of the tonguing and grooving planes running with the slides, and the mode of adjusting the same in combination with the surface plane the cam wheels and levers, substantially in the manner specified, for planing, tonguing and grooving boards and plank at one operation.

"And finally, the mode of contracting and expanding the grated bed in the manner specified, in combination with the tonguing and grooving planes."

DESIGNS FOR MAY, 1850.

1. For a *Design for Painted Floor Cloth;* Deborah, Albert E., and Nathaniel B. Powers, Lansinburgh, Rensselaer county, New York, assignees of James Hutchison, Troy, New York, May 14.

Claim.—"What is claimed as my invention, is the arrangement of ornamental figures, forming a design for floor cloths as shown in the aforesaid drawing."

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2. For a *Design for Stoves;* Washburn Race, Seneca Falls, Seneca county, New York, May 14.

Claim.—"What I claim as my invention, is the ornamental shape and configuration of the respective pieces of casting for a stove, as represented in the accompanying drawings and herein specified."

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3. For a *Design for Stoves;* D. Root, Cincinnati, Ohio, May 21.

Claim.—"What I claim as new, is the particular form and design as described."

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4. For a *Design for Stoves;* Asa C. Brownell, Providence, Rhode Island, May 28.

Claim.—"What I claim as my invention, is the combination of the elongated horizontal panels, and vertical connecting panel, all having mouldings in alto relievo—with the several doors and panels having Gothic arches, with clustered raised ribs on their sides and mouldings, as specified and shown."

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5. For a *Design for Stoves;* Joel C. Bailey and Russel Wheeler, Utica, New York, May 28.

Claim.—"What we claim as our invention, is the design of the form of the plates, consisting of the peculiar manner the same are ornamented and constructed."

List of American Patents which issued in June, 1850, *with Exemplifications by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Suspending Venitian Blinds;* Joseph Bohrer, Philadelphia, Pennsylvania, June 4.

Claim.—"What I claim as my invention, is the combination of pulleys with cords for the independent movement of the supporting slat, in the manner and for the purpose described."

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2. For an *Improvement in Ventilating Railroad Cars;* Hezekiah Bradford and Ephraim Morris, City of New York, June 4.

The patentees say,—"The object of our invention is to introduce into the several cars of a railroad train, a current or currents of air taken from some point or points forward of the smoke pipe of the locomotive, and thereby not only to supply the cars with the required ventilation, but at the same time to produce in each car of the train an outward pressure of air, which will effectually prevent dust, smoke and sparks from entering the cars; and to this end the nature of our invention consists in combining with the railroad train a tube or tubes, united at the junction of each car in the train by a flexible or yielding joint, the said tube or tubes being carried forward of the chimney of the locomotive to receive the air in the front of the train, and the said tube or tubes being made to communicate with each car of the train, so that the current of air forced by the motion of the train into the forward end of the tube or tubes where, from its location, the air cannot be charged with dust, smoke or sparks, may by the said motion be caused to pass the said tube or tubes into each car of the train."

Claim.—"What we claim as our invention, is the method of ventilating the cars of a railroad train, and keeping out dust, smoke and sparks, by combining therewith a tube made in sections and united by flexible joints at the junctions of the cars, which tube receives a current or currents of air forward of the chimney of the locomotive, and discharges it into the cars through apertures, all substantially as herein described."

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3. For an *Improved Gun Harpoon;* Robert Brown, New London, New London county, Connecticut, June 4.

Claim.—"What I claim as new, is attaching the line to both the shank and the head of the harpoon in such a manner that the extremity of the line is loaded with the harpoon into the gun, and lays in recesses made in the shank, and when the gun is fired the line will trail from the butt of the shank, and will not tend to depress the head during its flight."

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4. For an *Improvement in Fire Place Grates;* Gardner Chilson, Boston, Massachusetts, June 4.

Claim.—"What I claim as new, is, 1st, the combination with the open fire place or grate having the side draughts as described, of the air heating chambers, consisting of an air chamber surrounding the fire and a projecting chamber above surrounded by heat, substantially as set forth.

"2d, I claim dividing the draught of an open fire, and causing the products of combustion, to be drawn off at each end of the fire, as described.

"I also claim the sliding collar at the exit pipe in the manner and for the purposes specified."

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5. For an *Improved Method of Making Shafts, &c., of Sheet Iron;* Charles F. Fisher, New Orleans, Louisiana, June 4.

The patentee says,—"My invention consists in the construction of shafts for steam engines, water wheels, and other machinery, of the greatest possible lightness, compatible with strength and stiffness, and not expensive in construction."

Claim.—"What I claim as new, is the constructing of hollow plate iron shafts of short cylinders, combined and connected together in the manner and for the purposes above described."

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6. For an *Improvement in Printing Presses;* Charles W. Hawkes, Boston, Massachusetts, June 4.

Claim.—"What I claim as my invention, is, 1st, the application of the toggle lever working on the stationary cam, to raise the platen in the manner and for the purpose described.

"2d, I claim the combination of the toggle lever and toggles with the stationary cam, substantially in the manner and for the purposes set forth.

"3d, I claim the combination of the toggle lever and toggles, with the swing platen, as set forth.

"4th, I claim the combination of the spiral springs and the trip, when used in combination with the swing platen, substantially in the manner and for the purpose described."

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7. For an *Improvement in Brick Presses;* John W. Hope, City of New York, June 4.

The patentee says,—"My brick machine is constructed to grind the clay and to force it into the moulds; it also grasps the mould box firmly while the ground clay is being forced into it, and stops the discharge of clay from the machine when the filled moulds are withdrawn, to be replaced by empty ones."

Claim.—"What I claim as new, is operating the roll for holding the mould box, the gate for regulating the discharge of clay, and the piston for compressing the clay into the moulds by means of a wheel, furnished with series of teeth secured to it, and acting through trundles, shafts, cranks, and connecting rods, connected with the roll, the gate, and the piston respectively, substantially as herein set forth."

8. For an *Improvement in Gang Ploughs;* Joseph D. Hope, Philadelphia, Pennsylvania, June 4.

Claim.—"What I claim as new, is the spur wheel so constructed and arranged within the periphery of the driving wheel, that it may be made at pleasure to pass its rowels through the holes or notches in the tire into the surface of the ground when under compression, and thereby grapple and gain adhesion to the ground, substantially in the manner set forth.

"2d, I also claim the combination of parallel bars to regulate the breadth of each separate furrow, with the adjusting curve for determining the horizontal direction of the draught, so as to adapt the amount of work done by a single traverse of the engine, to the adhesive power of the wheels when applied to the particular kind of land under cultivation, substantially as set forth.

"3d, I also claim preventing the choking of the plough by means of the recurved point of the mould board, acting to turn aside and guide backwards the choking material, as set forth.

"4th, I also claim the manner of connecting the harrow to the locomotive, so that the conductor may at pleasure, by turning a crank, reverse its advancing side, for the purpose of freeing the harrow teeth from choking materials, in the manner substantially as set forth."

9. For an *Improvement in Board and Log Rules;* Charles B. Hutchinson, Waterloo, Seneca county, New York, June 4.

Claim.—"What I claim as my invention, is the combination with the inner revolving plate of the rotary tape measure of the several tables thereon, substantially as described."

10. For an *Improvement in Shuttle Motion of Looms;* Oliver A. Kelly, Woonsocket, Providence county, Rhode Island, June 4.

Claim.—"What I claim as my invention, is attaching the 'bat wing' by an adjustable connexion to one extremity of a lever, whose outer extremity is connected by a short strap, with the picker-stick, the lever turning on a single adjustable vertical pivot, and being interposed between the wiper operating as described, and the picker-stick, motion from the wiper being transmitted through this lever strap and picker-stick to the driver, so as to cause it to throw the shuttle with the proper degree of suddenness and velocity when the loom is working at a high speed; this arrangement admitting of the easy and quick graduation of the suddenness and velocity with which the shuttle is thrown, as set forth."

11. For an *Improvement in Nursery Chairs;* Samuel S. May, Sterling, Worcester county, Massachusetts, June 4.

Claim.—"I claim the improvement of the movable back piece and its sustaining fixtures, in their application to the back and seat, substantially as specified, and for the purpose of using the chair either as a cradle or as a lolling chair, substantially as specified.

" I claim the above described improvement in the arm chair, the said improvement consisting in so combining one of the arms with the seat, by means of a slide adapted to such seat, that both the arm and slide may be moved in a direction away from the other or stationary arm, so as not only to lengthen the seat, so as to enable it to support a mattress or bed disposed on it, but to render the arm a foot guard for an infant or child placed on the said mattress or bed."

12. For an *Improvement in Flying Horses;* Eliphalet S. Scripture, Greenpoint, Kings county, New York, June 4.

The patentee says,—"The nature of my invention consists in providing one or more mechanical horses upon a revolving platform, and in the centre erecting a series of cams around a centre post, and by hanging the horses at a point near the hip upon a centre, so as to admit of the head and forward part of the horses rising and falling, the before named centre serving as a fulcrum. I then connect, by levers, the forward part of the horse, so that the levers will come in contact, and be put in operation by a set or series of cams, each lever having a flexible connexion to the horses, and one after the other in succession, to be acted upon as the platform revolves, and thus by the rising and falling of the forward part of the horse, produces an undulating motion very nearly resembling the natural motion of a horse when galloping."

Claim.—"What I claim as my invention, is the combination and arrangement of the undulated cams with the levers, and these with the flexible connexions to the front part of the horses, for the purpose of, and by which I produce the rising and falling motion, which I term the galloping motion, as herein before described."

13. For an *Improvement in Electro-Magnetic Machines for Shocks;* Samuel B. Smith, City of New York, June 4.

Claim.—"What I claim, therefore, as my invention, is separating the shock derived from the initial secondary current of the double coil magneto-electric machine from that of the terminal secondary, by causing the latter to pass through a closed circuit, substantially in the manner and for the purposes set forth.

"I also claim the manner of adapting the same machine to transmit both the initial and terminal secondary currents at pleasure, by bearing off the spring by the arm, substantially as described."

14. For *Improvements in Carding and Mixing Wool and Cotton;* Stephen H. Adams and John A. Wood, Cohoes, Albany county, New York, June 11.

The patentees say,—"The nature of our invention consists in mixing the wool and cotton together after they have been passed through separate pickers, and through two carding machines separately."

Claim.—"What we claim as our invention, is the picking and carding of the wool and cotton separate from each other, and the drawing them off together from the second carding machine, and then mixing their fibres with each other by means of the finishing or condensing card."

15. For an *Improvement in Connecting Whiffletrees with Carriages;* James Barnes, Franklin, Delaware county, New York, June 11.

The patentee says,—"The nature of my invention consists in so connecting the whiffletrees to a carriage that, although I allow the required freedom of motion, I am enabled to guard against the danger which usually results from a trace breaking or becoming unhitched, viz: the end of the whiffletree to which a trace remains attached is drawn forward so far as to permit the horse to draw out of the shafts, and the contact with his legs also causes fright. By my improvement the whiffletree retains its appropriate position when only one trace remains attached to it."

Claim.—"What I claim as of my own invention, is the stops or blocks cast upon or otherwise affixed to the box, and the stops or blocks cast upon or affixed to the follower, in such manner that when the two are joined by a central bolt passing through, they will interlock and form a stop coupling, secure from derangement from external causes; the whole being constructed substantially in the manner described."

16. For *Improvements in Hydraulic Apparatus for Producing Blast;* Ransom Cook, Saratoga Springs, Saratoga county, New York, June 11.

Claim.—"What I claim as my invention, is, 1st, the use and application of boxes, tubes, or cavities, attached to wheels, disks, or arms, by movable joints or journals, and then carried in a rotary direction alternately through air and water, said boxes or cavities moving at the same time on their own journals in such a manner that they shall enter the water with their open sides downwards, and when beneath the same shall empty or discharge the air which has been compressed within them by the water, into a receiver which is separate from such wheels and air boxes; all for the purpose of producing a blast or air to be used in heating, smelting, and other mechanical operations.

"2d, I also claim for this purpose the disk, recess, or concavity of the wheel, so as to allow the receiver to project over the mouths of the air boxes to receive their compressed air.

"3d, I also claim for the same purpose the cam, the cranks J J J, and the cranks K K K, attached to the air boxes, together with the piece on the open side of the boxes, the mouth for discharging their compressed air, and the block for throwing forward the cranks J J J."

17. For a *Machine for Cutting Leather into Hollow-Ware Forms;* Richard E. Rabeau, Philadelphia, Pennsylvania, assignee of François Durand and Onesiphore Pecquer, Paris, France, June 11.

Claim.—"What we claim as new, is the combination of the vibrating knife with the fluted rollers, constructed and operating substantially in the manner and for the purpose fully set forth, one of which rollers being fluted longitudinally, and the other circumferentially, serve firmly to hold the leather in any position."

18. For a *Method of Forming Embankments, Levees, &c.;* Duff Green, Dalton, Murray county, Georgia, June 11.

The patentee says,—"My invention consists in conveying the earth from the site whence it is to be removed to the place where it is to be deposited, by means of a current of water caused to flow artificially in a trough or trench from the one place to the other with sufficient velocity to carry along with it the earth thrown therein, but which, when it arrives at the place of deposit, has its velocity sufficiently checked to be no longer capable of carrying along the earth, which is therefore deposited."

Claim.—"What I claim as my invention, is the method herein described of depositing earth to form embankments, levees, &c., and to fill up low situations, by means of filtering dams, or their equivalents, and a trough or conduit conveying earth and water from a higher level, substantially as specified."

19. For an *Improvement in Adjusting Packing for Oil Boxes of Axles, &c.;* Warner Groat, Troy, New York, June 11.

The patentee says,—"In my improvement I employ a metallic band surrounding the packing, so that it shall be adjustable by a nut and screw (or any other convenient mode) from the upper side of the box, so that when the packing wears away it may be pressed to the journal, and rendered oil tight until it (the packing) is worn out."

Claim.—"What I claim as new, is the employment of an adjustable band surrounding the oil packing of railroad car or other journals, so as to admit of adjustment from the outside of the box, in adjusting the packing around the journal and render the box oil tight, in the manner and for the purpose substantially as herein described."

20. For *Improvements in Cars for Plank Roads, Wooden Rails, &c.;* Gideon Morgan, Calhoun, McMinn county, Tennessee, June 11.

The patentee says,—"My invention consists in the mode of employing endless chains around proper guides for supporting and carrying a car or locomotive, and in the manner of keeping the chains tight, by which I obtain greater adhesion on the track, and a greater facility of draft on the car."

Claim.—"What I claim as my improvement, is the combination of a chain of rollers with broad bearing surfaces, running around a stationary rail or track on the carriage, with an independent chain which forms a track for said rollers to travel over when resting on the ground, and which passes around outside of said chain of rollers.

"I also claim the mode of constructing said track chain by lapping the links thereof, so that the rollers shall have a constant bearing on the three plates which form two succeeding links, and break joint with each other, as represented."

21. For an *Improvement in Bedstead Fastenings;* Charles H. Parker, New Geneva, Fayette county, Pennsylvania, June 11.

The patentee says,—"My invention consists in a device by which the rails and posts of a bedstead are firmly united, and can yet be easily and quickly disconnected, while at the same time the mattress is strained. Also in a mattress constructed in such manner that its upper surface is more tightly strained than its lower, thus always affording a level support for the body of the sleeper, the weight of which, acting upon the rail fastening, tends to unite the posts and rails more securely together."

Claim.—"What I claim as new, is the device for securing the ends of the side rails to the posts, consisting of a headed tenon on the rail, and two wedge-shaped and dove-tailed boxes in the post, the latter held in place by the pendent arms and tie-rods, by which the mattress is stretched, substantially as herein set forth."

22. For an *Improvement in Spring Mattresses;* William F. Ressegiue, Cincinnati, Ohio, June 11.

The patentee says,—"The nature of my invention consists in constructing the mattress, bed, or cushion, in such a manner that it can be used on either side, and folded or rolled up whenever occasion may require; and the same can be stuffed with hair, moss, or any other suitable substance."

Claim.—"What I claim as my invention, is the construction of the jointed spring mattress, substantially as set forth."

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23. For an *Improvement in Threshing Machines;* Elisha S. Snyder, Charlestown, Jefferson county, Virginia, June 11.

The patentee says,—"The improvements that I have invented consist in making the threshing cylinder with curved wings inside the cylinder and moving with it, and so formed as to act as a fan, for the purpose of drawing the dust from the hopper wherein the feeder stands, and from the upper part of the machine, and blowing or forcing it out with the chaff, or through a suitable way formed in a convenient part of the machine, and for forcing currents of air through the spaces between the ordinary riddle and screen, to carry off the dust, chaff, and other filth mixed with the wheat, as the latter passes through the separator and riddle and over the screen, the air being drawn in at one end of the cylinder and forced out at the other end, and thence driven horizontally or obliquely, or in any required direction, through the separating and cleaning part of the machine.

"Also, in forming the concave, in which the cylinder revolves, of adjustive star or other shaped teeth, perforated in the centre, and strung upon rods secured in the timbers of the frame by nuts or other means, so that when a point or protuberance of any one of the teeth wears off or becomes broken, it can be turned on the rod and again secured by the nuts

"Likewise in forming a spring grating for separating the straw from the grain before passing on to the separator, and arranging the same in the space between the concave and the separator.

"Also, the manner of combining and arranging a rock shaft, arms, and connecting rod, for increasing or diminishing the motion of the shoe containing the separator.

"Also, the arrangement of a vibrating rack at the end of the separator, for throwing the straw off at the rear of the machine.

"Also, combining an elevator with the separator, for raising and dropping the grain, after leaving the screen, into an inclined spout, where it is subjected to the action of another current of air, by which the remaining dust is blown from it previous to its descent into the bag or receiver.

"And also, in the employment of a wire guard or screen, to prevent the entrance of straw, sticks, stones, and other extraneous matters into the centre of the cylinder."

Claim.—"What I claim as my invention, is surrounding the twisted wings with an imperforated case, and placing the same inside the threshing cylinder; the whole revolving together in the manner and for the purpose set forth.

"2d, Constructing the concave of adjustive star or other shaped teeth, attached to rods fastened to the frame, substantially as described.

"3d, Placing the curved spring rack between the concave of adjustive teeth and the vibrating separator, in the manner and for the purpose described."

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24. For an *Arrangement of Mirrors in Traps;* James Stevens, Middletown, Frederick county, Maryland, June 11.

The patentee says,—"My invention consists in a trap constructed in such a manner that the rat who looks at the bait shall see his own image reflected by a mirror in such a position as will lead him to believe that a second rat is endeavoring to get before him in seizing the bait; and when the first rat has been caught his image will also be reflected by a mirror, so that the next rat who shall look at the bait shall see two rats apparently striving to seize it, thus decoying him upon the turning floor, which yields to his weight and precipitates him into the body of the trap."

Claim.—"What I claim as new, is the arrangement of the mirrors, substantially in the manner and for the purpose set forth."

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25. For an *Improvement in Planes for Tongueing and Grooving Boards, &c.;* James A. Woodbury, Boston, Massachusetts, June 11.

Claim.—"What I claim as my invention in said apparatus, is the combination of a gouge or gouges, (for removing the bulk or greater portion of a shaving in forming tongues or grooves in boards or planks,) with smoothing tools having a chisel edge, a cutting or side lip on either or both sides thereof, (for smoothing the sides and bottom of the grooves, and the edges about the tongues, as set forth,) said gouges being set in front of said smoothing tools, and the whole being arranged and operating substantially as set forth."

26. For an *Improvement in Machines for Finishing Morocco;* Edward Bookhout and Henry Cochen, Jr., Williamsburg, Kings county, New York, June 18.

Claim.—"What we claim as our invention, is, 1st, a sliding head with finishing tools (one or more) attached, said tools to be held down by weights or springs; said sliding head to do its work while in a backward or forward motion, and running straight ways, as set forth.

"2d, We claim as our invention the application of one or more clasps for the purposes described, in combination with one or more finishing tools, whose motions are parallel with said clasps.

"We also claim the application of one or more finishing tools, which are held stationary while rubbing the skin or paper, and allowed to revolve a little when required to equalize the wear on the peripheries of the same."

27. For an *Improvement in Spring Teeth of Hay Rakes;* Zephaniah Breed, Weare, Hillsborough county, New Hampshire, June 18.

The patentee says,—"The nature of my invention consists in applying the spiral spring in a way to form a self-supporting spring tooth."

Claim.—"What I claim as my invention, is the construction of the spring teeth of the hay rake of a double wire, in place of the single one generally used, as described."

28. For an *Improvement in Attaching Neck-Yokes to Poles of Carriages;* James M. Brown, Bloomfield, Trumbull county, Ohio, June 18.

Claim.—"What I claim as my invention, is the mode described of constructing the neck-yoke, either solid or divided, and fitting the tongue or pole of the carriage, and these, so constructed and fitted, in combination with the movable band on which are projections or knobs, by which means the whole are securely connected, and thus form a universal joint for the purpose stated and not otherwise."

29. For an *Improvement in Parlor Stoves;* Gardner Chilson, Boston, Massachusetts, June 18.

Claim.—"What I claim as new, is the arrangement of the flues in combination with the fire chamber, substantially in the manner and for the purposes set forth."

30. For an *Improved Method of Making Nails by Rolling;* Elisha H. Collier, Scituate, Plymouth county, Massachusetts, June 18; patented in England, September 11, 1845.

Claim.—"What I claim as new, is the auxiliary furnace, in combination with the machinery for rolling nails, &c., as described, for retaining the heat of the plates or rods of iron while they are separately passed into the machine."

31. For an *Improvement in Machines for Dressing Stone;* Robert Eastman, Concord, Merrimack county, New Hampshire, June 18.

Claim.—"What I claim as my invention, is dressing stone by means of chilled cast iron burrs, substantially as set forth."

32. For an *Improvement in Furnaces for Calcining Gypsum;* Benjamin Fowler, Lubec, Washington county, Maine, June 18.

The patentee says,—"My improvement consists in constructing the apparatus with three chambers, (in addition to the pan or boiler commonly used,) so that each chamber may contain a charge, and all be heated at the same time by the fire in the furnace under the pan by means of tubes or pipes passing from the furnace upward through all the chambers.

"And in forming the bottoms or floors of the two upper chambers of beams or bars, brought to an edge at the top, and filling the intervening spaces with slides or movable valves, so that the charge may be readily let fall into the chamber next below.

"And in making the sides and bottom of the lower chamber in the form of inclined planes, (descending toward the door,) so that on opening the door the charge will readily run into the pan, or boiler, where it is to be finished in the common way."

Claim.—"What I claim as my invention, is the combination of the pan or boiler with the three chambers, when they are combined with the beams, slides, and dampers, when the whole is constructed, arranged, and combined, so as to operate substantially, according to the method, and to effect the purpose substantially as herein described."

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33. For an *Improved Spike Machine;* Ammi M. George, Nashua, Hillsborough county, New Hampshire, June 18.

The patentee says,—"My machine consists essentially of a revolving wheel containing the dies for griping and pointing the spike, acting in combination with a pair of knives for severing the spike rod, and a heading tool, by which the head of the spike is pressed into shape."

Claim.—"What I claim as new, is, 1st, the rising and falling guide and cutter frame in combination with a moving series of dies, whereby the spike rod is guided into the moving dies, and a slip of proper length cut off to form the spike, the knives being operated by levers which force them towards each other whenever the movement of the frame brings the levers in contact with stationary arms projected from the main frame.

"2d, The forked and hinged clamp, constructed substantially as set forth, in such a manner that when open, its inner fork performs the office of a gauge to regulate the length of the spike, and when closed, its outer fork gripes the shoulder of the spike during the heading, and its inner fork is withdrawn to allow the formation of the point.

"3d, The combination of the arm with the clamp and its tongue, by means of which the heading, griping, and pointing of the spike are effected, substantially as described, at one operation"

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34. For an *Improvement in Upright Piano Fortes;* Lemuel Gilbert, Boston, Massachusetts, June 18.

The patentee says,—"My first improvement is upon the frame of the piano, and is devised for the purpose of giving additional strength to said frame, so that it may more effectually resist the strain of the strings.

"My other improvements are in the action of the said upright pianos, and consist in the use of a regulating button on the key lever, which serves, by being altered from time to time, to keep the jack close to its work in throwing the hammer—also in connecting the back catch directly to the jack in part, and partly to the hammer butt; and lastly, in combining a regulating button, passing through the swinging part of the jack with the butt of the hammer, by which I am enabled to regulate the throwing off the hammer by throwing the jack out sooner or later after each blow."

Claim.—"What I claim as my invention, is, 1st, combining with each of the standards of the frame, a sustaining and strengthening rod, arranged in a curved groove in the back of said standards, and operating substantially as above described.

"2d, I claim connecting the stem to the rocker bar fastened to the key as described, and also to the horizontal arm on which the jack, &c., is supported—by which the whole action becomes attached to the key lever, and the hammer is made to return when the end of the key lever descends, all as set forth.

"I also claim combining the back catch with the fly of the jack as set forth, and in combination with a jack and back catch so arranged, the curved arm projecting from the hammer stem, and having a regulating button connected to said arm, as set forth.

"Lastly, I claim regulating the throwing off the hammer from the strings by the projection from the centre block of the hammer, and below its centre of action, in combination with a regulating button passing through the fly of the jack."

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35. For an *Improvement in Apparatus for Raising the Grate in Cooking Stoves;* Ira M. Mead, Mogadore, Summit county, Ohio, assignee of Benjamin K. Maltby, Cleveland, Cuyahoga county, Ohio, June 18.

Claim.—"What I claim as my invention, is the apparatus for lowering and raising the grate, so constructed as to act without liability to obstruction from the baking of ashes between the parts of the machinery, having sliding pieces or racks furnished with perforations instead of cogs, in combination with pinions acting upon them by cogs, said pinions having the spaces between the cogs beveled, bringing them to a kind of edge, thus admitting no flat spaces to intervene where ashes may accumulate to prevent the working of the machinery."

36. For *Devices for Moving and Holding a Piston Breech Pin;* William W. Marston, City of New York, June 18.

Claim.—"What I claim as new, is the arrangement of the parts described and shown, in which arrangement the radius bar is connected to the rear end of the sliding breech pin by a tenon and slot, taking a pin on the jaws at the rear end of the breech pin for the purposes of holding the breech pin in place while the charge is exploded, removing the breech pin to receive successive charges, and forcing the charge into the barrel by replacing the breech pin for the next successive discharges, the whole constructed, arranged, and acting substantially as described."

37. For an *Improvement in Safety Stirrups;* Nathan Post, East Cleveland, Cuyahoga county, Ohio, June 18.

The patentee says,—"The nature of my invention consists in providing a safety bar, so arranged that in case the rider is thrown from his horse, the foot cannot hang in the stirrup."

Claim.—"What I claim as my invention, is the safety bar and the spring arranged in the form set forth, or in any other form, substantially the same in principle.

"2d. The arrangement of the loop cap by which I place the stirrup bars at right angles with the stirrup strap.

"3. The flat bar rising from the top of the loop to prevent the rolling of the stirrup in the strap."

38. For an *Improvement in Feed Apparatus for Mills;* John Sherlock and William Brackbill, Portugal, Juniata county, Pennsylvania, June 18.

Claim.—"What I claim as new, is the feeding apparatus as above described, for keeping a regular supply constantly fed to the grinding surfaces."

39. For an *Improvement in Apparatus for Parti-Coloring Yarn;* Alexander Smith, West Farms, Westchester county, New York, June 18.

The patentee says,—"In the method which I have invented for this purpose, the yarns to be partly colored are rolled around two rollers or reels, either fluted or made of wire, and placed one at each end of a frame. The journals of either one or both of the said reels working in slides connected with the frame. One or any number of these reel frames are then suspended to a vertically sliding frame operated by appropriate machinery, by means of which the reels with the yarns on them can be let down into a vat containing the dyeing or coloring liquor, the depth of immersion being indicated by a scale either marked on or suspended to the frame of the reels.

"After the required immersion the reel frames are removed, and either reversed to immerse the other end, or the reels turned to bring another part of the yarns in the proper position, depending on the pattern to be produced—and then again dipped in the same or another color. After the yarn has been immersed, the immersed reel is drawn up by the slide, that the rods or flutes of the reel may not be in contact with the yarn, which contact would have the effect of preventing the free access of the dyeing liquor to the entire surface of the yarn, and thus leave an imperfect color."

Claim.—"What I claim as my invention, is the method substantially as herein described, of parti-coloring yarns, by winding them on reels arranged in frames so constructed as to admit of immersing in dyeing liquor such portions of the yarn as are desired to be dyed, and shifting the same for dying other parts in like manner, substantially as described.

"And I also claim connecting one or both of the reels in each frame by means of slides, to admit of removing the reel from contact with the yarns whilst in the process of dyeing, substantially as specified."

40. For an *Improvement in Mills for Grinding;* J. R. Stafford, Cleveland, Ohio, June 18.

The patentee says,—"The nature of my invention consists in combining a pair of crushing rollers, or a series of pairs of crushing rollers, acting, in conjunction with each other, with a disintegrator composed of a rapidly revolving cylinder or fanner, working in a suitable concave or casing in such a manner that grain or seeds conducted between the said rollers will be throughly crushed and broken thereby, and then will pass into the disintegrator, and be minutely disintegrated or pulverized during its passage through the same."

Claim.—"What I claim as my invention, is the combination of crushing rollers with a disintegrating apparatus, arranged and operating substantially in the manner and for the purpose as herein set forth."

41. For a *Combination of a Guide Tooth with an Inclined Scraper;* John F. Wood, Homer, Terre Bonne Parish, Louisiana, June 18.

Claim.—"What I claim as new, is the guiding tooth or revolving cutter combined with the inclined scraper, substantially as stated for regulating the course of the machine."

42. For a *Model for Vessels;* Solomon Andrews, Perth Amboy, Middlesex county, New Jersey, June 25.

The patentee says,—"The object of my invention is to obtain increased speed for boats, by an endeavor to overcome certain difficulties arising from the necessary displacement of the water to float them, and the increased resistance from friction and inertia of the water caused by increase of speed.

"This I obtain by giving to the boat such a shape as will diminish its draft as the speed is accelerated, and as a consequence of this construction, I accomplish the injection of a small volume of air under the bottom, by the mere onward progression of the boat, and thereby still further reducing the friction of the water by diminishing the surface in actual contact."

Claim.—"What I claim as my invention, is the forming a vessel with a scow shaped bow, having on its sides two wide keels running the whole or a part of its entire length, and so constructed, that a portion of the inclined surface of the bottom shall always be above the water at the bow, and this with or without the supplementary keels forming small channels, by which construction air enters at the bow in the manner set forth, and is retained under the bottom of the vessel for certain purposes described herein."

43. For *Improvements in Connecting and Disconnecting Hubs and Axles;* A. M. Billings and Thomas A. Ambrose, Claremont, Sullivan county, New Hampshire, June 25.

Claim.—"What we claim as our invention, is the method described of securely fastening the hub of a wheel to its axle, or easily detaching the same therefrom, to wit: by means of the two sliding plates combined with the double scroll shaped cam, in such a manner that by turning the said cam in one direction, the sliding plates will fasten the axle journal within the hub so securely that it cannot be unfastened by any jar, or shock upon the wheel; and by turning the said cam in an opposite direction, the sliding plates will be detached from their hold upon the axle journal and permit the wheel to be detached therefrom."

44. For an *Improvement in Setting Artificial Teeth by Atmospheric Pressure;* John A. Cleveland, Charleston, South Carolina, June 25.

Claim.—"What I claim as new, is the air chamber constructed and arranged substantially as set forth, and for the purposes described."

45. For *Improvements in Looms for Weaving Cut Pile Fabrics;* Mertoun C. Bryant, Lowell, Massachusetts, June 25.

Claim.—"What I claim as new is, 1st, the use in power looms for weaving cut pile fabrics of intersecting plates entering between the two pieces of cloth, and allowing the pile warps to cross and recross from one to the other, which extend through the reed, thereby forming on their upper surface a plane upon which one of the shuttles is supported in passing through the web, substantially as described.

"2d, The continuing of the intersecting plates to the outside of the warps by adding the within described false reed, or otherwise, for the purpose of supporting the ends of the intersecting plates, and for guiding the warps by them, substantially as described."

46. For an *Improvement in Brick Presses;* Thomas Culbertson and George Scott, Philadelphia, Pennsylvania, June 25.

The patentees say,—"The first part of our invention consists in the application of artificial heat to the pressing and moulding surfaces, in the pressing and moulding of bricks, and other articles made of clay or of earthy compounds, of which clay is the chief ingredient made by moulding and pressing.

"The second part of our invention, which relates to the method of discharging the moulded bricks from moulds, arranged in a reciprocating carriage, consists of elevating the followers in the moulds by combining the carriage which carries the moulds with a secondary carriage or carriages, with rollers running on inclined ways, so arranged that, as the carriage of moulds approaches its running out motion on either side, it shall act on the secondary carriage which, by the continued motion of the main carriage, is carried up inclined ways, that in rising it may act on the followers of the moulds, to elevate them in a vertical direction only, instead of having an oblique action as heretofore, which tends to cant them in the moulds."

Claim.—"What we claim as our invention, is the method of preventing clay from adhering to the surfaces which make pressure on it, or in which it is pressed, or moulded by the application of artificial heat to such surfaces, substantially as herein described.

"And we also claim the method of elevating the followers of the moulds for discharging the bricks, by combining with the carriage of moulds, a platform, or carriage, which slides on inclined ways, and which receives motion from a carriage of moulds, substantially in the manner and for the purpose specified."

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47. For an *Improvement in Atmospheric Churns;* Peter F. Ellicott, Philadelphia, Pennsylvania, June 25.

The patentee says,—"The nature of my invention consists in placing in any ordinary vertical churn, or suitable vessel containing milk or cream, an upright hollow staff, and connecting said staff at the bottom with a square or round hollow plunger or dasher, and plunging on the inside of said staff a valve in such a position that, when the staff and plunger are raised, the valve will open and allow the atmospheric air to fill the dasher; and when said staff and dasher are forced down the valve will close, and the air in the dasher be driven out through the body of the milk or cream, and by the frequent movement up and down of said staff and dasher, in the churn, and through the cream or milk, butter will be formed."

Claim.—"What I claim as my invention, is a hollow staff connected with a square or round hollow plunger, with a valve placed at the top or at any point inside of said staff, said valve to be so arranged, that when the said staff and plunger are raised the valve will open, and when said staff and plunger are forced down, the valve will close, and the atmospheric air in the plunger will be forced through the body of the milk or cream, by which operation butter will be formed, said staff dasher and valve to be used in any vessel containing milk or cream."

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48. For an *Improvement in Electric Telegraphs;* George H. Horn, Boston, Massachusetts, June 25.

Claim.—"What I claim as my invention, is the above described new or improved electro-caustic telegraph, or application to telegraphic purposes, and substantially as specified, of heat generated by electric apparatus, or a current or currents of electricity passed through a fine platinum wire, or other proper conductors or equivalents therefor, as explained, the marks produced in or through the paper, or other material used in connexion with the heated wire, being regulated in their length and number, so as to be characters or expressions of letters, figures, or words, indicative of any message which it may be desirable to transmit from the battery end of the telegraph to the other end of the line; all essentially as set forth, or in the manner generally understood by telegraphic operators."

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49. For a *Machine for Forming Washers and Attaching them to Carpet Tacks;* Jason G. Howard, North Easton, Bristol county, Massachusetts, June 25.

Claim.—"What I claim as my invention, is the spring nippers arranged on a vibratory arm, and having a tapering bore, formed one-half in each of said nippers, for guiding the point of the tack to the centre of the washer. Also the combination of said nippers with the circular die and vertical moving punch, arranged and operating as set forth.

"I also claim a machine for preparing carpet tacks, consisting of the parts above stated, in connexion with an adjustable feeding motion, composed of the double endless bands, ratchet, and pawl, and parts which connect the same with the driving lever, as herein set forth."

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50. For an *Improvement in the Hinge of Rolling Iron Shutters;* A. Livingston Johnson, Baltimore, Maryland, June 25.

The patentee says,—"My invention consists in important improvements in that species of hinge or joint which is formed by locking the edges of plates or sheets of metal, by curling them spirally within each other."

Claim.—"What I claim as new in constructing the hinges or joints of rolling iron shutters of thin slats of iron, is having a bar or wire inserted within the coiled edges of the joint or hinge, to give strength and stiffness to the joint, said bar having its ends bent, to prevent the several strips of iron composing the shutter from sliding laterally on each other, and the projecting bent ends of the wire being covered by ears projecting from the ends of the strips and turned down, thus forming an even edge to the shutter, which will slide easily in the groove of the frame in which it is placed; the whole being constructed substantially as described."

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51. For an *Improvement in Producing Photographic Pictures upon Transparent Media;* John A. Whipple and William B. Jones, Boston, Massachusetts, June 25.

The patentees say,—"The nature of our improvements consists in coating the surface of glass, or other suitable media, with a film of matter containing metallic and alkaline salts, the precipitation of which produces the various shades and tints of the picture to be taken."

Claim.—"What we claim as our invention, is, 1st, the taking of photographic pictures upon transparent media by coating them with some suitable vehicle for the sensitive materials, substantially as set forth.

"2d, We claim the process of using the sensitive coating or film upon surfaces, whether of transparent, translucent, or opaque bodies, substantially in the manner and for the purposes set forth."

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52. For an *Improvement in Cooking Stoves;* Abraham Keagy, Middle Woodbury, Bedford county, Pennsylvania, June 25.

The patentee says,—"My improvements consist in so constructing the stove that the flue instead of conducting the flame and hot air from the fire firstly round the back and under the bottom of the oven, and then either returning under the bottom and back, or else having to cross itself after passing over the top of the oven through a box, it makes the hot air, after passing to the back of the fire, to return between the fire chamber and the top of the oven, and thence round it, by the front, bottom and back, to the chimney, or, if required, it can be made to pass twice round the oven before entering the chimney."

Claim.—"What I claim is the combination of the flues with a single damper, so that, by a single movement, I cause the hot air to traverse once or twice entirely around the oven at pleasure, substantially as described."

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53. For an *Improved Arrangement of Sash Stopper;* Nathaniel Myers, Charlestown, and Frederick C. Smith, Harper's Ferry, Jefferson county, Virginia, June 25.

The patentees say,—"The nature of our improvements consists in placing an eccentric within the bar or stile of the window sash, in such manner that it shall be made to act upon and against a weather strip secured in a groove or channel formed in the bar of the sash, instead of against the frame or window casing."

Claim.—"What we claim as our invention, is placing the eccentric within the bar or stile of the window sash, in such manner as to act upon a weather strip instead of against the frame or casing of the window, the former being thereby firmly pressed against the latter and all defacement of the window frame by the eccentric avoided, as described.

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54. For an *Improvement in Mounting the Knife of Straw Cutters;* John R. Nelson, Knoxville, Knox county, Tennessee, June 25.

Claim.—"I claim, of the above arrangement, the placing of the pivot of the knife upon a spring, for the purpose of enabling the operator to give the knife a draw or sliding cut."

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55. For a *Machine for Repairing Roads;* Nathaniel Potter, East Hamburg, Erie county, New York, June 25.

The patentee says,—"The nature of my invention consists in a frame or carriage of timber of suitable strength and form, supported at its front end on a pair of wheels, which are mounted on a leading axle attached to the frame or carriage by a king-bolt, and supported at its back end by a broad roller extending across the entire width of the carriage, and having its axis working in suitable bushes or bearings in the frame or carriage. The said frame or carriage is provided near its front end with a pair of cutters nearly of the form of a quadrant, which are fixed in nearly a horizontal position on a level with, or at any required height above or below, the track of the leading wheels. The said cutters are for the purpose of cutting off the ridges of dirt at the sides of ruts formed in roads, and have a tendency to throw the earth so cut off into the rut."

Claim.—"What I claim as new, is hanging the cutters for cutting off the ridges at the sides of the ruts, the scrapers for scraping the dirt into the ruts, and the roller for pressing and smoothing the road, upon the same frame; all the said parts operating together in the manner and for the purposes substantially as herein set forth."

56. For an *Improvement in the Weed Cutters of a Cultivator;* Charles Rodger, Montpelier, Washington county, Vermont, June 25.

Claim.—"I claim the combination of the bar with the weed cutter, in the manner and for the purpose set forth."

57. For an *Improvement in Water Wheels, for Increasing or Diminishing their Diameters;* T. R. Timby, Cato Four Corners, Cayuga county, New York, June 25.

The patentee says,—"My improvements are, 1st, adjustable arms, by which the buckets or hands, as I denominate them, are expanded from, or contracted towards, the water, by means of which I can, with the same elements, form a wheel of any desired diameter to suit the head of water, the machinery or gearing to be driven and the amount of labor required to be performed.

"2d, The buckets are formed on a novel principle of construction for direct acting water wheels, by which I obtain the greatest effect from the impinging of the water thereupon."

Claim.—"What I claim as new, is the double adjustable arm, constructed as above described, for expanding or contracting the size of the wheel, for the above specific purpose, so that the absolute diameter of the wheel and arms shall be reduced or expanded to go within a suitable curve."

58. For an *Improvement in Self-Acting Cheese Presses;* John Underwood, Montpelier, Washington county, Vermont, June 25.

Claim.—"What I claim as my invention, is the arrangement of the rollers and wedges, in combination with the inclined planes, acting in the manner and for the purpose set forth, to produce a sufficient pressure upon the cheese or other article to be pressed."

59. For an *Improvement in Boot-Trees;* William Upfield, Lancaster, Fairfield county, Ohio, June 25.

Claim.—"What I claim as my invention, is the combination of the sliding wedges, and the right and left screws, with the inclined planes or grooves C C, substantially in the manner and for the purpose set forth; the screws being made to play within the groove D, and being confined to its place longitudinally by the bar working in the groove H."

60. For an *Improvement in Carriages;* Miles S. Watkins, Somerville, Fayette county, Tennessee, June 25.

Claim.—"What I claim as my invention, is the combination of the open elliptical axletree with the sliding slotted frame attached to the body of the vehicle, and passing through the upper half of the axletree, and attached to the upper leaf of the elliptical spring placed inside of the axletree, the lower leaf of said spring being secured to the inner side of the lower half of the axletree; the several parts being arranged and operating in the manner and for the purpose set forth."

61. For an *Improvement in Waste Gates;* Hiram Yaw, Boston, Erie county, and Thomas P. How, Buffalo, New York, June 25.

The patentees say,—"The nature of our invention consists in providing mill ponds, canals, and reservoirs, with a waste gate hung upon a vertical axis, the lower part of which is made wider one side of the axis than it is the other, the side which is narrowest towards the bottom of the gate being sufficiently wider than the other towards the top that the balance of the pressure of the water will change from one side of the axis to the other, and open and close the gate as the water rises and falls."

Claim.—"What we claim as our invention, is a waste gate which is hung upon a vertical axis, the lower part of which is made wider one side of the axis than it is the other, the side which is narrowest towards the bottom of the gate being sufficiently wider than the other towards the top, that the balance of the pressure of the water will change from one side of the axis to the other, and open and close the gate as the water rises and falls."

RE-ISSUE FOR JUNE, 1850.

1. For an *Improvement in the Machine for Boiling and Washing Rags for Manufacturing Paper;* John Campbell, City of New York, assignee of George Spafford, Windham, Windham county, Connecticut; patented September 2, 1840, re-issued June 11, 1850.

The patentee says,—"The invention consists in digesting with an alkaline or other liquid, in a close turning vessel, the rags or other fibrous materials for making paper pulp, the heat being applied to the exterior of the vessel, or by steam introduced within it, as may be deemed most expedient."

Claim.—"What is claimed, is the herein before described process of preparing materials for making pulp in the manufacture of paper, by digesting them in a turning vessel with an alkaline solution or other liquid, the heat being applied to the outside of the vessel, or by steam introduced within it, substantially as set forth."

DESIGNS FOR JULY, 1850.

1. For a *Design for Umbrella Stands;* Walter Bryent, Boston, Massachusetts, June 4.

Claim.—"What I claim as my production, in the new design for an umbrella stand, consisting of branches of a grape or rustic vine cast in a twisted form about the basin, and then rising vertically and crossing each other to form the stem, from which other branches project horizontally, and are turned so as to form the loop holes, all as set forth."

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2. For a *Design for Coal Stoves;* John T. Davy, Troy, New York, June 4.

The patentee says,—"My design consists of arabesque ornaments; the stove is square, each side and the back being the same in form and figure as the front represented, excepting the sides are made whole instead of a door as at *a*, the back having a pipe hole situated in the panel *a*."

Claim.—"What I claim as new, is the ornamental design and configuration of stove, substantially the same as herein described and represented."

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3. For a *Design for Stoves;* Amos Paul, South New Market, Rockingham county, New Hampshire, June 11.

Claim.—"What I claim as my invention, is the combination of the bull's eyes in alto relievo, (having radial notches as described,) and of alternating concave and convex radial ribs and surrounding mouldings on the several doors and panels of the front and side plates, and the row of pointed leaves, and of alternate notches and ridges, on the moulding of the hearth plate, all as set forth."

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4. For a *Design for Stoves;* E. P. Penniman, Rochester, New York, June 18.

Claim.—"What I claim as my production, is the combination of the four ornamental figures, as represented."

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5. For a *Design for Stoves;* John F. Rathbone, Albany, New York, June 18.

Claim.—"What I claim as my production, is the combination and arrangement of ornamental figures and forms represented in the accompanying drawings, forming together an ornamental design for a parlor stove."

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6. For a *Design for Stoves;* John F. Rathbone, Albany, New York, June 18.

Claim.—"What I claim as my production, is the combination and arrangement of ornamental figures and forms represented in the accompanying drawings, forming together an ornamental design for a cooking stove."

7. For a *Design for Stoves;* James Wager, David Pratt, and Volney Richmond, Troy, New York, June 18.

Claim.—"What we claim as new, is the ornamental design and configuration of the plates, as described and represented."

8. For a *Design for Stoves;* Job E. Owens, Jacob Ebert, and Elbridge G. Dyer, Hamilton, Butler county, Ohio, June 25.

Claim.—"What we claim as new, is the combined ornamental design and configuration of plates for a cooking stove, substantially as herein set forth."

9. For a *Design for Stoves;* Washburn Race, Seneca Falls, Seneca county, New York, June 25.

Claim.—"What I claim as my invention, is the design of the top and bottom stove plates, represented in the accompanying drawings, and herein set forth."

10. For a *Design for Cooking Stoves;* William L. Sanderson, Troy, New York, June 25.

Claim.—"What I claim is the design and configuration of cook stove, as described and represented in the annexed drawings."

MECHANICS, PHYSICS, AND CHEMISTRY.

To the Committee on Publications of the Franklin Institute.

Description of the Solar Magnetic Engine, invented by Wm. W. Hubbell, Esq., *Philadelphia.*

Gentlemen:—Herewith you will receive a correct copy of my specification of the "Solar Magnetic Engine." The leading feature in the invention is the solar magnet, one of which, (Fig. 1st and 2d,) now in my possession, and embodying much power, was used by me, experimentally, as early as December 22d, 1841. Caveat papers, then executed and retained by me, show that this system of magnetic powers was known to me at or before that time.

The organization of the engine is the development of the system, of which the solar magnet is the controlling centre or foundation. Without it the system of powers could not exist.

Wm. W. Hubbell,
Att'y and Counsellor at Law, &c.

Philadelphia, July 24, 1850.

Copy of Specification.

Magnetism I believe to be a fluid which pervades all material things, though in different degrees, and that it will pervade soft iron and steel to the greatest degree. It has two qualities within its nature—a positive and a negative; which in different bodies attract each other, while each seeks to diverge from its kind in different bodies by repulsion. Positive magnetism, or that of the North Pole, results from the zinc portion of a galvanic battery; and negative magnetism, or that of the South Pole, results from the copper or iron portion of a galvanic battery. The production of magnetism by a galvanic battery, called electro-magnetism, is common, and the method well known at the present day.

In order to enable others skilled in the art to make and use my solar engine, I will proceed to describe its construction and operation, reference being had to the annexed drawings, making together with the written descriptions thereon, accompanying Figures 3d, 4th, 5th, and 6th, Plate I, a part of this specification, and on which like letters refer to like parts hereafter explained.

The principle or character of my invention is based upon principles which I have deemed as a guide in developing my invention, to exist in the solar system of the universe; and being intended by me, so far as may be necessary to obtain an organized mechanical power and motion, as an imitation of the solar system, I have thought proper for elucidative purposes, to designate my invention the "Solar Magnetic Engine." Its nature is based in imitation as follows: I suppose the sun or centre of the system to be possessed of the magnetic principles of attraction and repulsion, and exercising these influences at every point of an unbroken circumference around a common centre or axis; its face possessing equal capacity of power at any circumferential, with any other parallel circumferential point, to attract direct to, and repel directly from this common axis or centre.

I therefore construct a centre or solar magnet to embody within its own nature these aforesaid principles. This magnet, with the variable modes that have occurred to me of constructing it, are hereinafter described.

To imitate the planets revolving about, and governed by the sun and each other, as far as, for my purpose of attaining available power in machinery is necessary, I have one, two, three, eighteen, or fifty, more or less than two magnets vested with attractive and repulsive power, and playing about and governed by a common centre not coincident with the centre of the solar magnet, but so fixed near it, that these planetary magnets, by mutual attraction between each of them and the solar magnet, approach from their aphelion or farthest point of recedure, to their perihelion or nearest point of approach to the solar magnetic surface, and then by changing their poles relatively to this surface, when, or as they successively reach the nearest point of approach, they of the planetary and the solar magnet repel each other, until the receding planetary magnets respectively arrive again at their aphelion or point of farthest recedure, where their poles again rechange, and they of the planetary and the solar magnet attract each other, and thus the planetary magnets successively change at their points of aphelion and perihelion, and approach near to, and recede from, and revolve around the solar magnet; which solar magnet, at its every circumferential point, exerts its power on the revolving planetary magnets; and as within itself, owing to its formation, it concentrates and embodies, to and from its common centre, a great and uniform capacity of attractive and repulsive nature, so also when combined with the planetary magnets, it developes an uniform and continuous power for practical use, as an universally appropriative power.

With regard to the solar magnet, reference being had to figures 1st and 2d, it is constructed as follows: Figures 1st, 3d, 4th, and 9th are each a sectional view of different solar magnets, on a line extending longitudinally through the centre or diameter of the engine; figures 1st and 9th also showing some of the planetary magnets. It (the solar magnet) may be said to be a continuously circular horse-shoe magnet, or to consist of two circular plates (AA AA) joined in the centre or at the inner circle (BB) by a circular back, column, or cylinder (CC), either solid or hollow; or the two circular plates may be joined at the outer or largest circumferential surface (as in fig. 3d) by a circular ring, cylinder, or back; or as in fig. 4th, the magnet may have both an inner and an outer circumferential surface (DDDD DDDD) formed by connecting the two circular plates (AA AA), about midway between these surfaces, by a circular ring, cylinder, or back (CC); this magnet will then be a combination of the one in fig. 1st and 2d, and the one in fig. 3d; or another mode to combine them is to have them separate as first described, yet the one fig. 3d so small, and the one fig. 1st and 2d so large, that the former will set within the circuit of the back of the latter, and thus they, back to back, with or without a wood cylinder, or other non-conducting substance between them, will be effectively combined; or the latter may set within the former, face to face, as in figures 5th and 6th, and the planetary magnets approach and recede as indicated by their respective paths EE and EE; or they may further be combined as is expressed in figures 4th and 3d of the drawings. The solar magnet may consist of solid wrought or cast iron, or steel, or may be made of numerous thin plates of iron or steel (or other suitable metal) riveted, or screwed, or bolted, or otherwise secured together, or it may be made of soft wrought iron or steel strips, or wire, having the ends thereof to terminate and form the circumferential or magnetic surfaces of the magnet. The number of pieces of wire in this case must be very great, and each one bent to suit and construct the horse-shoe form of the solar magnet. I deem it best made of plates; and when the solar magnet is made of numerous pieces of thin plate or wire, each piece may be cut or spread of the shape displayed by figure 7th, the dotted lines (XX) indicating where it is bent to form the poles; of course, in this case the smaller pieces form the inside of the poles and the outside of the connecting cylinder or back in fig. 1st and 2d, and the inside in fig. 3d, and each succeeding piece must be as much longer than this as the thickness of the plate requires to make it fit to the former; and also the pieces forming each succeeding layer should be set over the junctures of the pieces forming the preceding layer, as in fig. 8th; a coil of the covered wire from the batteries may be put between each layer or between every second or third layer of plate or wire, to more effectually magnetize the said solar magnet. In the solar magnet, one circular end becomes a north pole, and the other one becomes a south pole; and the strongest magnetic power exists around the circumferential surfaces, and acts convergently and divergently to and from the common centre of the circle. This solar magnet may be either a permanent or an electro-magnet; when permanent, it should be of steel and be packed inside at the central part (F) and between the poles (GG) with loadstone, or it may be of wrought or cast iron, steel, or other material, and magnetized by means of a galvanic battery or batteries, in which case the coils of the covered wire should be wrapped in the space between the poles, both inside and outside of the cylinder or back, and also a coil or coils should be laid on the side of each pole (AA), thus and always covering the magnet with coils of covered wire as numerously, as heavily, *The "Solar Magnetic Engine," invented by William W. Hubbell, Esq., Philadelphia.*

Fig. 1.

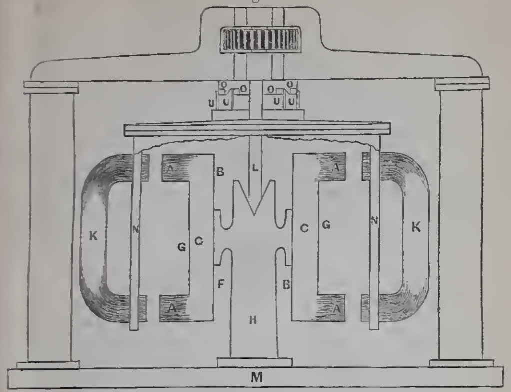


Fig. 2.

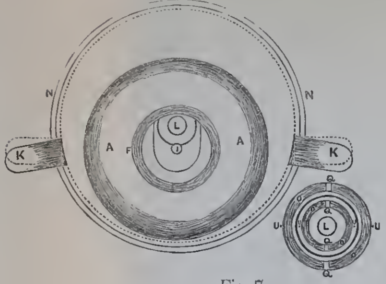


Fig. 3.

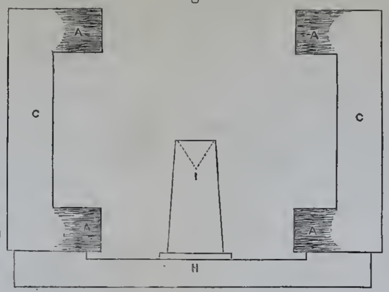


Fig. 4.

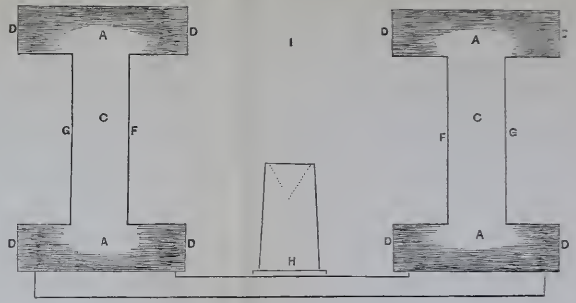


Fig. 8.

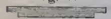


Fig. 7.

Fig. 5.

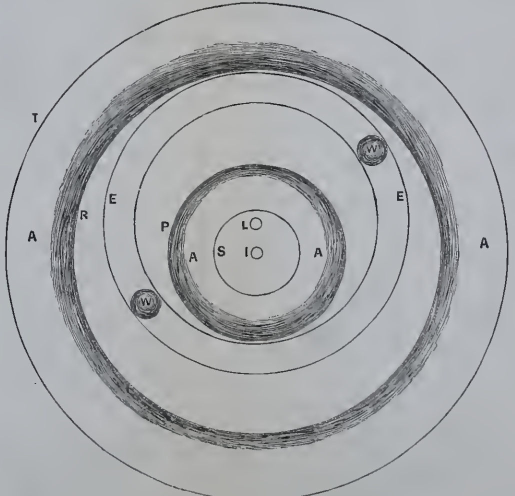


Fig. 6.

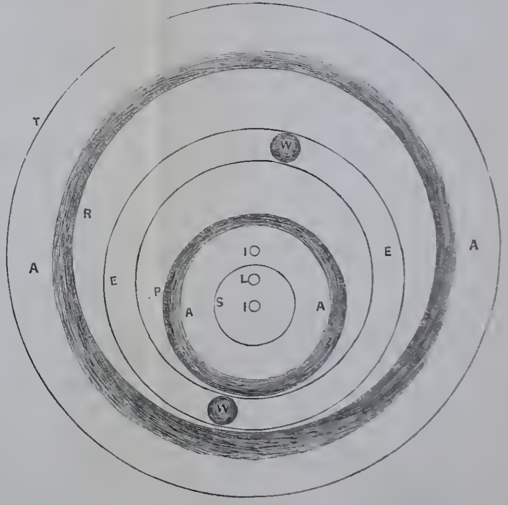


Fig. 9.

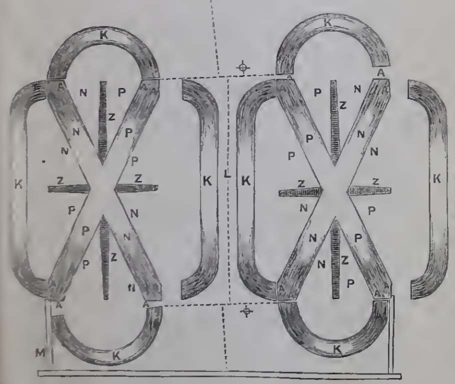
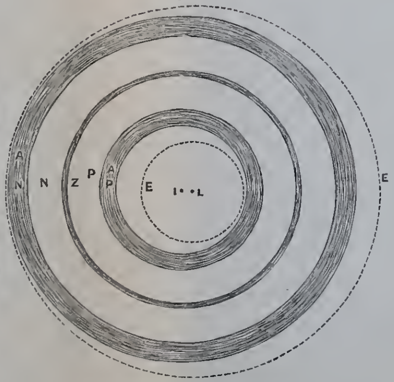


Fig. 10.



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and at every part, except the circumferential faces, as much as possible; and thereby giving those faces the greatest magnetic power.

And now as to the construction of the solar engine: I affix the solar magnet to a strong wooden (mahogany, maple, or oak, &c.) or suitable metallic base, (H fig. 1st, or H fig. 3d, or H fig. 4th,) the point I being the centre of this solar magnet; and around this solar magnet's magnetic surfaces I arrange the planetary magnets (KK, 50 more or less in number, figs. 1st and 2d); these are best made of numerous pieces of porous, soft, wrought iron wire, or they may be solid, and of the ordinary horse-shoe form, or they may be straight; their ends, heads, or faces towards the solar magnet, may present the inverse or converse curve of its faces, or be straight-faced, or rounded; the inverse or converse is the best; the breadth of their faces should be about the same as that of and directly opposite the faces of the solar magnet, and each magnet must be separate and distinct from the others; in this way they must be attached to a revolving frame, or cylinder, governed by its own independent centre or shaft (L), and this centre be near the solar centre (I), as in fig. 2d, so that the planetary magnets, as they revolve around the solar magnet, may successively approach as near as possible, without contact, to its faces; and then may recede from its faces to nearly the utmost extent of its influence. The modes of suspending or securing central shafts and bases, thus relatively to each other, are numerous, and well known to machinists. I have in the drawing shown the shaft suspended vertically, as I deem that the best relative construction for the engine, and have rested the planetary shaft on the central column, or base which sustains the solar magnet, and rests on the general engine base (M). I have sprung a metallic arch or beam resting on columns, over the engine, and resting on the general base, for the purpose of receiving the upper end of the planetary shaft (L), and also to hold the charging keys of the planetary magnets (KK *et al.*) The appropriative power of the engine can be taken from the upper part of this planetary shaft by cog-wheels, pulley-wheels, or any of the known means.

The beam, columns, and base, whenever the bulk is not material, are best made of wood, such as mahogany, maple, oak, &c.; so also the planetary frame is best made of wood. The engine may also be suspended horizontally, in which case the planetary shaft may rest on an oak or other wooden frame, on each side of the solar magnet; this any mechanic will know how to construct in numerous ways, without directions from me.

The number of engines may also be increased to two, four, ten, or any other number on the same shaft, the shaft being either vertical or horizontal, and the engines either above or horizontal to each other; or each engine may rest on its own shaft, and their power be concentrated on a single shaft by means of cog-wheels, pulley-wheels, or any of the known means of communicating power. One excellent method is to set numerous engines immediately under the circumference of a large cog-wheel, with a cog-wheel from the upper part of the shaft of each engine running in gear with it, and thus they all concentrate their power into it. Another is, to set them under a horizontal shaft, and each give its power to it by means of a bevel cog-wheel on the planetary shaft, and another on the horizontal shaft.

Each of the planetary magnets should be secured between two wooden rings, or otherwise, to the revolving frame, or series of arms, or cylinder (NN), and each of these magnets is wrapped with covered wire to magnetize it from a battery; which wires (UUUU) are led to near the planetary shaft (L), where they are held in and by slots cut through a wooden ring, and those from the positive poles are in contact with positive semi-circuit keys, and those from the negative poles are in contact with negative semi-circuit keys. It is well known that the positive pole or semi-circuit key can be made negative, and *vice versâ*, by simply changing the wires from the one to the other nature of the battery. These semi-circuits (OO OO) around the planetary centre are four in number, are stationary with the arch or beam, and form two circuits, each having two breaks (QQ QQ), the one semi of each being positive, and the other negative; the one break where the poles change is opposite the perihelion or nearest point of approach to, and the other break is opposite the aphelion or point of farthest recedure from the solar magnet. The breaks consist of ivory, or other non-conducting substance; and as the wires from the planetary magnets, in revolving with their respective magnets, pass from one semi-circuit on to the other, either by platina or other metallic wheels on them, rolling in contact with the circuits, which is the best mode; or by having platina, or other metallic ends, which slide around against the circuits, they respectively cause their respective magnets to change from positive to negative, and *vice versâ*, end for end; and thus the planetary magnets continuously approach the solar magnet by attraction, and recede from it by repulsion, being continually under its influence and revolving around it. It is evident that, in their approach to the solar magnet, they may not be magnetized, as it will attract them; but I deem it best to magnetize them at this time, as well as necessary on their recedure. Copper wire, covered with cotton or other substance of a non-conducting nature, is usually employed to wrap magnets, in order to magnetize them by a galvanic battery. Any suitable covered wire may be employed in this engine, and wherever the charging keys and planetary wires are in a state of friction, platina is the best metal to use, as it will not readily oxidize; this fact is already well known in the art; therefore the semi-circuits of the charging keys (excepting the ivory breaks) are best made of platina, also the ends of the planetary wires, and the little friction wheels that run on them and bear against the keys, are best made of platina.

To charge the planetary magnets as heavily as possible, each pair of opposite magnets should have their own circuits of keys, in which case the circuits may be very small and above each other, and each charged by a separate battery; or, if this is not done, it is best to make as many conducting wire connexions, to and at equal distances along the circuit of the charging keys, as there are planetary magnets, in order to distribute the fluid and magnetize them effectively.

The revolution or the motion of the engine may be reversed, by mutually changing the wires of either the solar or planetary magnets in the battery. This may also be done by a simple lever with sliding conducting attachments, or in numerous ways.

In the engine having its solar magnet's face on the inner circle, as in fig. 3d, it will of course be seen that the planetary magnets are inside of its faces or circle; whilst with the solar magnet, as in fig. 1st and 2d, having its faces on the outside of the circle, the planetary magnets must revolve outside of the face of the solar magnet; and with the solar magnet, having both the inside and outside circumferential faces, as in fig. 4th, there must be two series of planetary magnets, the one to revolve inside, and the other outside. And also, when the solar magnet fig. 1st and 2d is combined inside of the solar magnet fig. 4th, and at the same time the solar magnet fig. 3d is combined outside of fig. 4th, these two series of planetary magnets have the whole attractive and repulsive power of these four solar faces thrown on them, to furnish appropriative power to the engine. When numerous series of planetary magnets are employed, presenting themselves to different solar faces, each series of planetary magnets should have its polar ends let into, and should stand between, two wooden rings or cylinders, having arms connecting them between the magnets, and extending from both series to a hub, by which they concentrate their power in its, their common centre or shaft, as the appropriative power of the engine. The heads or polar ends of the planetary magnets may have their faces curved, coincident with the inner and outer curves or circles of the rings holding them; and the straight magnets, having their heads or polar ends enlarged each side of the coils of wire, are best to present their faces to these combined solar surfaces.

In this system of magnetic machinery, the planetary path (EE) in figs. 5th and 6th respectively, by way of variable capacity, may be considered as composed of covered brass, or copper tracks, or electro-magnetic wires, conductors, or keys, the one half between the aphelion and perihelion, on the one side of the solar magnet, separated from the other half between the perihelion and aphelion, on the other side of the solar magnet, by ivory or other non-conducting substance; and one of the planetary magnets (E) be a conical wheel or rolling ball of soft wrought iron; the said keys being one positively and the other negatively charged. In this case, the balls or wheels will be continuously changing from positive to negative, and *vice versâ*, as they pass the points of aphelion and perihelion, and thus run or roll around the solar magnet. In this instance, the planetary path need not be perfectly circular, but may be similar to the orbits of the planets, and the number of planetary magnets, wheels, or balls, with their respective paths or orbits, may be increased to any such number as the face, or size of the solar magnet, will admit of presentation to it. This variable capacity of the system, it will be perceived, is not so well calculated to give appropriative power, as where the power is imparted to the central shaft (L), as described, which may in this case also be done by coupling the two balls, by means of a wire running through the shaft (L), jointed if the path be an orbit, or not jointed if it be circular.

Another variable mode of employing the solar magnetic principle, or character, is displayed by fig. 9th. This variable mode consists in providing the solar magnet with eight circular faces, two faces to each pole (AA AA AA AA), so as to present four series of planetary magnets (KK KK KK KK), each series consisting of as many magnets as can be presented to the solar circuits or faces, to act in concert with them. This solar magnet has its four poles (PP NN PP NN), converging and diverging to and from its centre, and also the same poles diverging longitudinally.

Between the poles are wooden diaphragms (ZZ ZZ ZZ ZZ), to separate the negative and positive coils of wire that magnetize it, by means of the galvanic batteries; the letters P, between the poles, denote the positions of the coils of wire positively charged, while the letters N denote the coils negatively charged, and the letters P, on the poles, denote the positive poles, while the letters N, on the poles, denote the negative poles. By changing the wires from positive to negative, and of course *vice versâ*, these poles change in like manner.

This solar magnet is, of course, continuously circular; fig. 10th is a side view of it. When the four series of planetary magnets (KK *et al.*) are presented to it, a cylindrical base (M) supports it, and the lower series of planetary magnets revolves inside of the cylinder base. This lower series of magnets may be dispensed with, losing however its effective power; and, in that case, the lower diaphragm may be extended down, and form the cylinder base; or the lower side of the solar magnet may rest on a flat wooden base. The series of planetary magnets within and outside of the circuit of the solar faces, approach and recede the same as those in the other figures; and the upper and lower series of planetary magnets approach and recede as they revolve about the solar faces, by the planes of their revolution being at acute angles (⌖⌖) respectively, with the planes of the solar faces, or the side solar faces, caused by inclining their respective axles, or shafts, on which they revolve.

These axles are stationary, and sustain the shaft (L) of the inner and outer series of planetary magnets, and the hub or centre of the upper and lower series rests and moves on friction rollers; the said axles or shafts may also be made to revolve with them, by toggle-joints or bevel cog-wheels connecting them to the central shaft (L).

These series of planetary magnets change their poles at the points of perihelion, or nearest approach, and aphelion, or farthest recedure, as they revolve around or about the solar faces, similar in mode or principle to those presented to the other solar magnetic faces.

It will be apparent to any person, from this specification, that the number of solar magnets, and that the number of series of planetary magnets to constitute a single engine, may be increased to any extent, on the system herein set forth. Also that the solar magnets may be slightly changed in form, and still preserve the same distinctive principle or character; for example—the poles of solar magnet fig. 1st, fig. 3d, fig. 4th, respectively, instead of extending parallel to each other, may converge or approach each other, and thus resemble more minutely the horse-shoe curve; in this case, each pole, instead of presenting the form of a plane ring, would be the frustrum of a cone, or, if with a curved side, the segment of a hollow sphere. The planetary magnets may also be slightly modified in form, still observing the general principles here laid down, in their relation to the solar magnet or magnets.

And various modes, the principle of which is well known, for wrapping the horse-shoe magnets, may be employed for wrapping the solar magnets with the covered wire, to charge them as highly with magnetism as possible. The ordinary magnets are found to be most highly charged by wrapping each pole with several series of coils, the positive being the proximate or commencing wire for one pole, while the negative is for the other; I apply this system to the solar magnets. And I wrap the positive portion on one side of a wooden or other suitable diaphragm, and the negative on the other side, carrying the wires from one to the other nature, through the diaphragm, when and as I wrap numerous series of coils, the one over the other successively, and also when side by side. The diaphragm may be dispensed with, but it allows a greater body of wire to be coiled when desired *without contact;* and, if desired, still a greater body can be coiled with the positive and negative *not distinctively separated*, by dispensing with the diaphragm. I carry the positive and negative wire of each series of coils respectively, through an ivory bush let into the respective side of the solar magnet, by which the wires do not interfere with the faces of the solar magnet, and they charge it heavily with magnetism. The upper wires are generally led over the upper side, on a wooden flanch or ring, (two of which hold the outside coils in contact with the outer sides of the poles respectively,) until they reach near the centre of the solar magnet, where they are led down through its supporting wooden column, or, if metal, through an ivory bush, and, together with the lower wires, are attached to their respective poles or natures of the galvanic battery. To charge the solar magnet or magnets heavily, and thus make them most efficient, the galvanic battery or batteries should always be used; and the planetary magnets, owing to their change of poles at the points of aphelion and perihelion, should always be electro-magnets, or made magnetic by means of the galvanic batteries.

Having fully described the principle, or character, of my invention, so as to enable any mechanic, of ordinary ability, and skill, to understand its nature, and to construct and use the same, I wish it to be understood, that, as respects the planetary magnets in their separate natures, I do not claim them; they being only the ordinary and well known kind of magnets. But, I do claim to be the original and first inventor of the solar magnet, in its principle, or character, and the various modes of constructing it, herein set forth.

I also claim the mode of combining, or placing, any, or all, of said solar magnets relatively with each other, or together, as described.

I also claim the combination of the engines described, on the same shaft, or around the cog-wheel, or with the horizontal shaft, to which they unitedly impart their power, as described.

And finally, I claim the application of the planetary magnets, to revolve around, or about, the solar magnet or magnets, substantially, in the manner, and on the principles, herein described.

Wm. W. Hubbell.

Additional Explanation of Plate I.

Figure 4th. The solar magnet fig. 1st and 2d may set within this one, and thus have three solar faces acting on two series of planetary magnets, the inner series as in fig. 5th or 6th, and the outer series as in fig. 1st and 2d, both series affixed to the same shaft.

Figure 3d. This formation of solar magnet may set outside of the form fig. 4th, and thus have *four* solar faces acting on two series of planetary magnets; this, fig. 3d, being relative to the planetary path, either as the outer magnet in fig. 5th, or as the outer magnet in fig. 6th.

Figure 5th. L is the centre of the planetary magnets' path EE. AA of the inner solar magnet is the north pole, while AA of the outer solar magnet is the south pole, and *vice versâ*. I is their centre. P is the face, and S the back of the inner solar magnet. R is the face, and T the back of the outer solar magnet. W W are two of the planetary magnets, of which EE is the path.

Figure 6th. L is the centre of the planetary magnets' path EE. AA of the inner, and also AA of the outer solar magnet, are both either north or else south poles at the same time. I I are their respective centres. S is the back, and P the face of the inner solar magnet; and T is the back, and R the face of the outer solar magnet. W W are two of the planetary magnets, of which EE is the path. W. W. H.

For the Journal of the Franklin Institute.

Investigation of the Comparative Merits of the Perpendicular and Radial Paddle Wheels for Sea-Going Vessels. By B. F. Isherwood, Esq., *Chief Engineer, U. S. Navy.*

The perpendicular (sometimes called vibrating) paddle wheel, or paddle wheel whose paddles enter and leave the water perpendicularly, has never been introduced into this country, though extensively used in England and France, both in government and private steamers. The object of this arrangement of the paddles is to avoid the loss of labor by the oblique action of the common radiating paddle wheel. While, however, effecting this object, which is done by the combined movement of an eccentric and a number of jointed levers, it causes another loss of labor from the frictions of the eccentric strap, and the joints of the levers, and this friction amounts to a very considerable per centage, as will readily be appreciated when it is considered that action and reaction being equal, there is sustained by the acting paddles of a paddle wheel the same pressure that is sustained by the steam piston of the engine, which same pressure is sustained also by the various journals transmitting the power of the steam piston to the vessel. The mean of many experiments made to ascertain the friction of metal on metals with lubrication, has been found to be about 10 per cent. of the pressure. But in the case of the steam engine, the pressure is not a *statical* but is a *dynamical* one; that is, it is composed of pressure and the velocity at which the pressure moves; but this product expresses also the power of the engine, wherefore, the friction of the load, that is, of the reaction of the vessel on the journals transmitting the power of the steam piston to the vessel, is one tenth of the power; and, as before stated, action and reaction being equal, the acting paddles sustain this same pressure, and in the perpendicular paddle wheel they turn under this same pressure; wherefore the friction will be as before, one-tenth of this pressure; that is, one-tenth of the total power developed by the engine. That this is correct will be demonstrated from the experimental data hereafter examined. Now, the losses of labor by the common paddle are slip and oblique action, and, as has already been stated, the losses of labor by the perpendicular paddle wheel are slip, and the friction of its moving parts, in addition to which there is a further serious loss by reaction when the horizontal speed of the entering perpendicular paddle is less than the velocity of the vessel, as will be explained hereafter. But slip being entirely dependent upon surface of paddle, it is evident that whatever slip can be given to one wheel can be given to the other, using the proper quantity of paddle surface for that purpose. The comparison is then narrowed down between the loss by oblique action of the radiating paddle wheel, and by friction of its moving parts and reaction of the perpendicular paddle wheel. The loss of labor by the friction of the paddle surface on the water, and by the direct resistance of the paddle edges, may be considered as equal in the two wheels; and is, moreover, too small an absolute quantity to be considered in a general calculation.

The best arrangement of paddle surface for the common radiating paddle wheel, is evidently to make it as long and as narrow as possible, and to make the tip edge of the paddle coincide with the surface of the water. This arrangement for minimum narrowness reduces the slip to the minimum for a given amount of surface, because the slip must be calculated for the centre of pressure or reaction of the paddle; and it is obvious that the nearer the centre of reaction approaches the outer or lower edge of the paddle, the less will be the displacement or slip; for even if the centre of reaction have no slip, that part of the paddle surface comprised between it and the outer edge of the paddle will operate a displacement.

Making the top edge of the paddle to coincide with the surface of the water, gives the minimum of loss by oblique action; for the less the immersion of the paddle proportionally to the diameter of the wheel, the less will be the vertical composant of the power; because the sine of the angle under which the paddle presses the water vertically will be the less.

But in practice these arrangements are wholly unattainable. In the first place, the length of paddle is restricted by practical considerations; any increase beyond a certain point is accompanied by such decreased strength in the guards, and increased weight in the wheel, as well as by the inconvenience of an excessively broad vessel, (over the guards,) that the paddles of the largest sea-going vessels rarely exceed eleven feet in length. The careening of the vessel also operates a depression of the leeward paddle and a raising of the weather paddle, and, taking the centre of the ship for the centre of oscillation, (not strictly true,) it is evident that this depression and rise is in proportion to the distance between the exterior ends of the paddles of the opposite wheels.

This variation from a horizontal line is injurious to the economical performance of the wheels, with whose normal action it seriously interferes. The length being thus determined, and a certain area of paddle being required to propel with the desired slip, that area must be given by breadth of paddle, which has the twofold disadvantage of requiring deeper immersion to cover the paddle, thereby increasing the loss by oblique action, and of raising the centre of reaction, thereby increasing the slip. It is moreover wholly impossible to make the top edge of the paddle coincide with the water surface, from the varying draughts of water of the steamer from the moment of starting, caused by the consumption of fuel; and from the careening of the vessel, which would, with such an arrangement, lift the weather paddle partly or wholly out of water. It may be taken as a mean with sea-going vessels of medium size, supplied for a voyage of nine days and over, that the variation of draught by reduction of fuel is about three feet; to this must be added $1\frac{1}{2}$ foot for careening of the vessel and $2\frac{1}{2}$ feet for depth of paddle, and we have for the least mean immersion $\frac{(1\frac{1}{2}+3+2\frac{1}{2})+(2\frac{1}{2}+1\frac{1}{2})}{2}=5\frac{1}{2}$ feet.

Such a proportion of paddle placed on the circumference of a circle of 28 feet diameter, the paddles being about $3\frac{1}{2}$ feet apart, would propel a vessel of 2600 tons displacement and 590 square feet immersed section, with a slip of about 18 per cent., and a loss by oblique action of about $18\frac{1}{3}$ per cent. This loss by oblique action becoming of course less with vessels making shorter voyages, and having proportionally less variations of draught; and also with vessels having wheels of larger diameter, the *absolute* immersion remaining the same. We are again, however, met by difficulties in increasing the diameter of the wheel; in the first place, it requires engines of longer stroke in order to avoid the too great friction caused by the leverage of the centre of reaction of the paddle on the crank pin; and in the second place, the resistance of the wheel houses to the air, the weight of the wheels and housing, &c., are serious disadvantages. In attempting, then, by means of better theoretical proportions for the radial paddle wheel than those now used in practice, to avoid certain losses, we encounter other losses and inconveniences, offsetting or exceeding the gain. It may therefore be considered as settled, that with the ordinary radiating paddle wheel in sea-going vessels of medium size, making voyages of nine days and over, that the loss of labor by slip cannot advantageously be reduced below 20 per cent., nor the loss by oblique action below 18 per cent., making a total of 38 per cent. It is true, however, that the resistance of the water to displacement is greater at greater depths in the proportion of the depths. The greater therefore the immersion of a given paddle, the less will be its slip, but each increase of immersion increases the loss by oblique action, and a point is soon reached where the increased loss by the latter exceeds the increased gain by the former. To push the immersion farther than this is evidently to sustain a greater total loss.

If now, however, the paddles be made to enter, traverse and leave the water perpendicularly, the loss by oblique action is avoided; and if the centre of reaction (which will be as before, one-third the width of the paddle from the outer edge) have no slip, the portion of surface between it and the outer edge of the paddle having the same horizontal velocity, will operate no displacement. Furthermore, by this arrangement, the same absolute paddle surface will propel with less slip than in the radiating paddle, by the difference between the projections of the surfaces horizontally, the perpendicular paddle having its whole surface acting, while the radiating paddle acts but by that surface multiplied by the cosine of the angle under which the paddle strikes the water. For equal slips, then, less absolute propelling surface is required in the perpendicular than in the radiating paddle.

As oblique action is avoided with the perpendicular paddle, and as the losses of labor occasioned by the radiating paddle are slip and oblique action, and as slip is affected by depth of immersion, and as depth of immersion with the radiating paddle is only restricted by the oblique action, —it might be supposed, and has been so supposed by many, that the perpendicular paddle wheel could be immersed advantageously nearly to the axis. This is, however, far from being the case, and for the following reasons:—

With the radiating paddle wheel composed of a number of paddles set around on the periphery *radially*, their propelling efficiency depends on their *horizontal velocity*. Suppose a horizontal line drawn tangential to the lowest point of the periphery of the wheel, and from the centre of pressure of each paddle a perpendicular be let fall upon it, the distances between the intersections will represent relatively the horizontal velocities of the paddles. Now, it is evident that such paddles as have a *less* horizontal velocity than the velocity of the vessel, so far from propelling, carry a mass of water before them; this mass of water, however, occasions no further loss of labor than that due to its friction on the paddle surface and wheel shaft journals, (a very inconsiderable quantity,) because action and reaction being equal and in opposite directions, the reaction of this mass of water on the paddle produces a force acting at right angles to the *radial* paddle, equal to what was communicated to it by the paddle, and this reactionary force at *right angles* to the radii of the wheel turns the wheel, and the turning of the wheel propels the vessel.

But this is not the case with the perpendicular paddle, which forms an angle with the arm or radius at the extremity of which it is set; and the reactionary force of the mass of water carried forward by it being transmitted at right angles to the perpendicular paddle, that is, horizontally, and consequently obliquely to the radius or arm, instead of at right angles to it, as with the radiating paddle, the *whole* of the reactionary force is not applied to turning the wheel, but a resolution of it takes place, and only one composant is applied at right angles to the radii to the turning of the wheel;—the other composant is applied in the direction of the arm or radius, and producing pressure on the shaft in that direction, is absorbed in retarding the advance of the vessel and in lifting it out of water. The proportion of power producing motion in the wheel compared to that lost in retarding the advance of the vessel, and lifting it, will be as the cosine to the sine of the angle under which the arm strikes the water.

It is plain, then, that by increasing the immersion of the perpendicular paddle wheel until the horizontal velocity of the entering paddle is less than the velocity of the vessel, a loss of labor is experienced by part of the reactionary force of the mass of water carried before the paddle being expended in pressure on the shaft, instead of the whole of it being expended, as in the radial paddle wheel in turning the wheel. We therefore reach the economical limit of immersion with the perpendicular paddle, as far as the reactionary force is concerned, when the entering paddle has a *less* horizontal velocity than the velocity of the vessel. To have, then, a deep immersion with the perpendicular paddle wheel without encountering reactionary loss, it must be constructed with such amounts of surface as to give a normal slip for that immersion; that is to say, the immersion will determine the horizontal velocity of the entering paddle, and in order that the velocity of the vessel shall not exceed this, the paddles already in the water, and having from their positions greater horizontal velocities, must have correspondingly greater slips, in order that none of the reactionary force upon the wheel be lost; but in practice, it will be found proper to ascertain the minimum of all the losses; that is, the minimum of the losses by the deficit of the reactionary force and by the slip of the paddles.

With a paddle wheel of 28 feet extreme diameter and 5½ feet immersion, the slip of the centre of reaction must be about 33⅓ per cent., in order that there be no loss of reactionary force by the entering paddle; that is to say, in order that the entering paddle carry no mass of water before it. If a slip of about 20 per cent. be given to such a wheel, the immersion must not exceed 3½ feet, in order to fulfil the above requirement. Notwithstanding this, however, the loss of labor by the loss of a portion of the reactionary force, is sufficiently small, with the deep immersions and slips found in practice, to allow a gain by the suppression of the loss by oblique action. Of course, actual experiment or calculation only can determine this amount and the conditions under which equilibrium obtains between the different losses and gains. Independently of the economical results that may arise from the use of the perpendicular paddle, in function of form, there are some important practical advantages connected with its use. The principal one consists in the fact, that a narrower wheel can be used with the same area of paddle, the only limit to the breadth of paddle being the depth of its immersion. In the "Medea," a vessel displacing over 1000 tons, the paddle is 40 inches by 5 feet, because the acting movement of the paddle is wholly horizontal, and the slip is the same for the whole paddle as for its centre of reaction. With such a wheel, the proper proportions of paddle would be the greatest breadth permitted by the immersion; and as this would give an excess of propelling surface, were the usual number of paddles used, as is customary with the radiating paddles, this number can be reduced very considerably; so much so, in truth, that the paddles can be placed at such a distance apart as will allow only so much surface to be always in action as may be necessary to prevent too great irregularities of motion. This distance can be much greater than with the radial paddle, there being no shock vertically on striking the water, as with the radial paddle. The paddles on opposite wheels should of course *break joints*, or alternate with each other, with a view to preserving this regularity of action. The practical advantages may be briefly summed up thus:—The wheel of equal propelling efficiency would have but about two-thirds the weight of the ordinary wheel, and half its width, diminishing the leverage upon the guard timbers and the strain upon the ship. By reason of the greater narrowness, there would be in the rolling of the ship less depression of the leeward and less raising of the weather paddle, with of course less irregularity of motion than with the radiating paddle. By avoiding the oblique action of the radial paddle, a very destructive strain upon the ship is also avoided, for the practical effect of the oblique action of the radiating paddle is to forcibly tear the sides from the bottom of the ship.

Let us consider generally the greatest loss of the reactionary force that will occur with the paddle in its most unfavorable position. That position will evidently be the one occupied by the entering paddle, because the obliquity of the radius of the wheel to the surface of the water is here greatest. In the deepest immersions this obliquity does not exeeed 45 degrees. Taking it then at 45 degrees, and supposing the paddle in a vertical position at the end of the arm, and supposing the horizontal speed of the paddle less than the speed of the boat: there would be a resolution of the reactionary force upon the arm or radius of the wheel into two equal portions, one of which would be at right angles to the arm, and utilized in producing rotary motion in the wheel; the other would be in the direction of the arm, and produce pressure on the shaft;—at the shaft, a new resolution of this half of the original reactionary force would take place into two equal portions again; one of which, or one quarter of the original reactionary force, would be opposed to the motion of the vessel directly in line of keel; the other, at right to the first, would lift the vessel, and consequently be utilized in decreasing the immersed amidship section and displacement of the vessel. This result, however, is too small to be appreciable in practice, and is proved to be so from the fact that the caps of the outward pillow blocks of the shaft are not pressed down to bear on the top of the shaft journal, but have generally a clear space of half an inch or more left between. Indeed, in many steamers there are no caps at all to these pillow blocks. It is evident now, that with this arrangement, were the action of the lifting force appreciable in raising the vessel, the shaft would be lifted out of its outboard pillow blocks; but observation shows that it has no perceptible lifting at all. The vertical resistance of the water is so small compared with the resistance of the weight of the wheel, shaft, &c., that the power expended vertically, displaces the water instead of lifting the vessel. As far then as practical results are concerned, the lifting force cannot but be considered as lost labor. We find then, that even in the most unfavorable case occurring in practice, the loss with the perpendicular paddle is the sum of the reactionary and lifting forces, which being 25 per cent. each, make a total of 50 per cent.

(To be Continued.)

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, July 18th, 1850.

Samuel V. Merrick, President, in the chair.

Solomon W. Roberts, Corresponding Secretary.

Isaac B. Garrigues, Recording Secretary.

John F. Frazer, Treasurer.

The minutes of the last meeting were read and approved.

Letters were read from Hon. Abbott Lawrence, Minister at London, and from The Massachusetts Chartiable Mechanics' Association, Boston, Massachusetts.

Donations were received from The Royal Institution of Great Britain; The Statistical Society of London; The Mercantile Library Association of St. Louis, Missouri; The Smithsonian Institution, Washington City, D. C.; Wm. Brady, Esq., U. S. Navy, New York; and Charles E. Smith, Esq., Philadelphia.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Board of Managers and the Standing Committees reported their minutes.

The Treasurer read his statement of receipts and payments for the month of June.

The Board of Managers reported that they had appointed the following Committee to have charge of the School of Design for Women:—Messrs. David S. Brown, Samuel V. Merrick, Frederick Fraley; Mrs. Sarah Peter, Miss Maria Tilghman, Mrs. J. F. Frazer.

New candidates for membership in the Institute (2) were proposed, and those proposed at the last meeting (6) were elected members of the Institute.

On motion, the following resolutions were adopted:

Resolved, That the Franklin Institute approve of the proposal made by the Massachusetts Charitable Mechanics' Association, for the holding of a Convention of Delegates from the different societies devoted to the promotion of the Mechanic Arts and Agriculture, for the purpose of affording facilities to those persons who may wish to have the products of their skill, or other native productions, forwarded to London, to be added to the great Industrial Exhibition of 1851.

Resolved, That the President be authorized to appoint five members to represent the Institute in that Convention.

Resolved, That this Institute recommend that the Convention be held in Philadelphia, and that they hereby tender the use of the Hall of the Institute for its purposes.

Resolved, That in accordance with the request of the Massachusetts Charitable Mechanics' Association, an invitation to join the Convention be forwarded to—

The Philadelphia Society for the Promotion of Agriculture.

The Young Men's Mercantile Library and Mechanics' Institute, Pittsburg, Penna.

The Mechanics' Institute of the City of New York.

The Rochester Athenæum and Mechanics' Institute, Rochester, N. Y.

The Maryland Institute for the Promotion of the Mechanic Arts, Baltimore, Md.

The Mechanics' Association, Columbia, S. C.

The South Carolina Institute, Charleston, S. C.

The Ohio Mechanics' Institute, Cincinnati, Ohio.

The Mechanics' Institute, Chicago, Illinois.

Resolved, That the delegates have power to fill any vacancy in their body, and to extend the invitation to such other societies for the promotion of Mechanics and Agriculture as they may think proper.

On motion, the President's name was directed to be added to the delegation when appointed.

On motion, it was

Resolved, That a memorial from the Institute be presented to Congress, asking that an addition of a Scientific Corps be made to the Commission on the Mexican Boundary Survey.

The Mayor and members of the Corporation of the City and Northern

Liberties, with officers of several Fire Insurance Companies, being present, Mr. G. W. Smith, in allusion to the recent destructive explosion in Water Street, would make a few simple experiments on explosions, with a view to determine whether nitre, under certain conditions, would produce results analogous to those then witnessed.

The first experiment would show that water thrown on fused nitre would cause a violent explosion. [This experiment was omitted on account of the danger attending its performance.] At the recent fire in Brooklyn, large masses of fused nitrate of potassa, and nitrate of soda, were seen flowing in streams; when one of these streams came in contact with the tar or melted rosin, of which large quantities were present, a most violent explosion took place. In the case of an explosion resulting from the contact of water with the fused nitre, it is due to the instantaneous generation of steam, rather than to a chemical decomposition; when, from the mixture of tar or melted rosin with the fused salt, there is probably a distillation of the organic matters and a formation of carburetted hydrogen, which, combining with the oxygen of the saltpetre, proves an explosive compound of great energy.

In the second experiment it was shown that, where 3 parts of nitre, 2 parts of carbonate of potassa, and 1 part of sulphur, are intimately mixed, and exposed to heat on an iron plate, the mixture turns brown, and a violent fulminating explosion takes place. This experiment was varied. In the second portion of it the same proportions were used, but the substances were not mixed; and in the third portion of the experiment a compound of widely different proportions, carelessly mixed, was exposed to the same heat. A melting and ignition of the sulphur was first observed, soon succeeded by vivid combustion, deflagration, occasional crepitations, with several minute explosions, then, after a few seconds' interval, two loud fulminating explosions; thus showing that definite proportions were not absolutely necessary in this compound.

In the third experiment it was shown that, where the materials for gunpowder were mixed in improper proportions, or slightly mixed, no explosion would take place, but a mere deflagration, producing gases which, if confined, might cause an explosion.

In the fourth experiment, a mixture of equal parts of nitre and charcoal alone was found to deflagrate in a similar manner.

Now in the building in question we had a large quantity of hay and straw, with sulphur, nitre, and molasses. Here we have all the elements for the generation of carburetted hydrogen, carbonic oxide, and oxygen, which, if mixed and ignited, would cause a violent explosion. We have also carbon from the hay, straw, and molasses, with burning sulphur and nitre,—all the elements for the production of an explosion.

After the above experiments were performed, portions of Augendre's white powder from chlorate of potassa, gun cotton, and gunpowder, were exploded, to show the relative character of their explosions.

Prof. Frazer, in reply to a request, stated that as he was absent from the city at the time of the accident, and had not even had an opportunity of examining the ruins, he would not, of course, presume to say what was the cause of the explosion. But it must be evident to every one at all familiar with chemical experimentation, that in the conflagration of a building containing large quantities of nitre, with organic materials, such as hay and molasses, and other combustibles, there were present all the elements necessary for an explosion much more powerful than gunpowder could give rise to. He stated that in the midst of a vast conflagration like this, the want of a sufficient supply of air would cause the organic substances to undergo destructive distillation in place of combustion; and thus a large quantity of inflammable gases would be generated, which, if mixed suddenly with the oxygen from the decomposing nitre, would cause an explosion of the most violent kind.

In support of this view of the method of decomposition of organic substances, he referred to a specimen of glass, now in possession of the Institute, from the great fire at Pittsburg. In this specimen panes of glass have been softened and almost entirely fused by the heat, while they bear upon their surfaces the most delicate impressions of the straw in which they were packed.

To show that an explosion might ensue from such a formation of inflammable gases in presence of oxygen, he also referred to an explosion of an iron smelting furnace, recorded in the "Annales des Mines," January, 1841, *(Journ. Fr. Inst., Vol.* III, *3d series, p.* 163,) caused by an attempt to use baked wood as fuel. In this case a series of explosions ensued by which the whole contents of the furnace were discharged *upwards.* Prof. F. also thought that an amply sufficient cause of the explosions might be found by supposing the melted nitre to fall upon sheets of the water which had been thrown, and was at the time pouring upon the burning building; and in illustration of his point, he stated that he had himself seen a quantity of melted lead accidentally poured into the gutter, at the corner of Minor and Fifth streets, occasioning an explosion by which the lead was thrown to the very tops of the houses. He also referred, for illustration, to the familiar fact of the explosion caused by the casting of iron into damp moulds, and especially to the recent destruction of a furnace near Pittsburg, by the attempt to purify the metal by bringing it, when fused, into contact with water.

Prof. F. also remarked the analogy of this explosion to that which occurred at the great fire in New York in 1845, as described by Dr. Hare, *(Journ. Fr. Inst. Vol.* XV., *3d series, p.* 452,) indicated by the succession of a series of explosions increasing in violence. He also thought that, had gunpowder been in the building in large quantities, the peculiar smell must have been observed by all the witnesses of the accident, and would have been found among the ruins for a long time after the event.

Dr. Turnbull read the following letter from Dr. Wetherill:

"First of all, I hold that, in the explosions at New York, Brooklyn, and Philadelphia, no gunpwder has been proved to be present in sufficient quantity to account for the explosions; we must, in absence of direct experiment, take it for granted that saltpetre will cause explosions under certain conditions; at least this is in the highest degree probable. Any other country, less reckless of life and limb than our own, would have settled this question long ago by direct experiment.

"It remains, I hope, for our own city to institute a course of experiments, not to stop until the matter is settled. Perhaps the best way of doing it would be for the city authorities to appoint a prize for the best essay (with experiments) on the subject; or else, the Franklin Institute might appoint a committee.

"In the second place, since, in the present state of the science of chemistry, a question like the present cannot be considered as settled without conclusive experiment, all that has been and will be said without experiments will only go to render the one view or the other more or less probable.

"The modes of accounting for the explosion that I have heard are two: 1st, That gunpowder was formed by the union of carbon, sulphur, and nitre. 2d, That of Prof. Rogers, that it was caused by a rapid development of oxygen gas.

"With regard to the first explanation, I think when we consider what great care is required for the preparation of a good powder, in what state of intimate contact must the three constituents be, and that even the granulation plays an important part, I cannot conceive how nitre, fusing and running down into charred molasses, with sulphur, could form an explosive solid (or liquid). Rapid combustion would no doubt ensue, but to my mind deflagration is much more probable than an explosion.

"2d, Nor does Prof. Rogers' explanation satisfy me. We have no experiments to prove that nitre will, under any circumstances, when heated alone, give off all its oxygen at once. A mixture of chlorate of potassa and peroxide of manganese loses oxygen much more readily than nitre, and when a large quantity of the mixture is heated in an iron bottle, and the heat suffered to rise too rapidly, although the gas (which is confined) comes over very quickly, it is in no respect like an explosion; the gas is always given off in successive portions.

"Another explanation which I would modestly submit, and which I do not remember to have seen stated anywhere, but which strikes me as very probable, is that, in all the above explosions, there was a mixture of explosive gases formed which caused the accidents. When a house burns, and especially a warehouse, which is constructed with thick walls and few windows, and when the air has not sufficient oxygen to burn all the carbon to (CO_2) carbonic acid, carbonic oxide is formed,—a gas which explodes violently with oxygen. That the dry distillation of substances stored away may give rise to other gases capable of exploding when mixed with oxygen gas, and that the water thrown in upon the burning materials may give rise to hydrogen gas, is not improbable. Now if we suppose such a mixture of gases to be in the house when the fire reaches the nitre, what may take place? As the nitre melts and gives off oxygen gas, at first slowly, this oxygen unites with a portion of the gases and explodes; then this goes on until the oxygen is evolved 'stormy,' as they say in German, when a large quantity of explosive mixture is formed, and the grand explosion takes place.

"These views are borne out in what took place at the late fire, as Dr. Rand can testify, who was near to the house when the explosion took place. They commenced by small ones, which increased in force until the grand finale. Others stated that the water thrown in upon the fire seemed to determine the explosion. It may be objected to this, that like explosions ought to take place when no nitre is present, explosive mixtures being formed with the oxygen gas of the air; but the cases are, I think, different. In the case of air, there is a longer time needed for the formation of an explosive mixture, since it contains only $\frac{1}{5}$th oxygen gas, and the air becomes deprived of its oxygen slowly, causing combustion without explosion; in the other case oxygen is generated rapidly, and not by coming in at burning crevices, but is evolved in the midst of the mixed gases."

Prof. Frazer remarked that the explosions of carbonic oxide were not usually violent, as was the case with carburetted hydrogen.

Dr. Rand would state that he was near the building at the time of the explosion, and had observed the facts closely. Soon after he observed the peculiar flame and smoke of burning nitre, an explosion was heard resembling the distant report of a cannon, or the tap of a large drum; this was followed by others of gradually augmented intensity, the interval between each gradually diminishing. He was not aware that any rubbish was thrown by these explosions, which, however, were marked enough to cause most of the spectators to leave. After about five or six of these deep, dead, explosions, three of terrific intensity followed, each one louder than the preceding. The second of these broke all the glass in the neighborhood and prostrated many persons, but the third shivered the burning building to pieces, and far exceeded all the rest. The ground shook perceptibly under the feet. Just before the three violent explosions, he noticed a fire company playing a very thick gallery stream into the second story windows of the burning building. Both himself and a companion were enveloped in the smoke from the explosion, but neither could detect the slightest smell of gunpowder smoke. The explosions were much sharper and quicker than those from blasting rocks, and the latter explosions had a different character from the first in this respect.

Dr. Kennedy inquired if Dr. Rand had seen any of the fumes of nitrous acid.

Dr. R. had seen a distinct light yellow fringe or border to the characteristic white smoke of the burning nitre; it had not, however, the orange hue of nitrous acid fumes, and there was no odor of that substance.

Dr. Turnbull had seen a patient of his friend, Dr. Greeg, whose face and neck were filled with small spots like grains of gunpowder, from this explosion. The true way to determine their nature, would be by an examination with a compound microscope. Instances were related by members of similar spots resulting from other explosions than those of gunpowder.

Mr. J. P. Wetherill would inquire why, where there was, as in this case, an enormous amount of partially carbonized matter, did not combustion take place instead of these explosions.

Professor Frazer replied, that in all cases the hydrogen took oxygen in preference to the carbon, unless a large excess of oxygen was present.

Mr. Wetherill believed that the truth could only be arrived at by actual experiment on a building filled with similar materials.

In allusion to a fire, accompanied by explosions, which had taken place in Water street, some ten years ago, Dr. Turnbull informed the meeting that it had been afterwards ascertained that there was gunpowder in that store.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

SEPTEMBER, 1850.

CIVIL ENGINEERING.

Extracts from the Report of PROF. ALEX. D. BACHE, *Superintendent of the Coast Survey, showing the Progress of that Work for the year ending November*, 1849.

Continued from page 90.

SECTION I.—*From Passamaquoddy Bay to Point Judith, including the coast of Maine, New Hampshire, Massachusetts, and Rhode Island.*—(Sketch A.)

3. *Astronomical and Magnetic Observations, &c.*—Mount Independence, near Portland, was occupied as an astronomical station by my party. It is nearly two degrees and a half north of Nantucket, and but thirteen minutes west of it: the arc of the meridian passing through Nantucket, will, however, be prolonged nearly a degree further north by the occupation of a station in direct connexion with this, increasing considerably the value of the measurement of the arc.

The observations for latitude were made with a new zenith telescope by Simms, of London, (C. S. No. 3,) and the zenith sector, by Simms, described in my report of 1846. The plan of observation was to determine the latitude with the zenith sector, by observations of certain standard stars, and the declinations of the smaller stars used in the zenith telescope with the same instrument, employing these in the computation of observations for latitude with the zenith telescope instead of the catalogue places. The results, stated in my report of last year, of the performances of the zenith sector, pointed out this course, and the trials now made will show conclusively its value. So far, the field computations confirm the advantages assumed for the method. I shall, at another time, present the numerical data for comparison. It may turn out that the errors of the catalogue are sufficiently corrected by multiplying the number of pairs of stars. The observations with the zenith sector were chiefly made by Sub-Assistant George Davidson and myself; those with the zenith telescope and with the transit instrument (C. S. No. 1) for time, in connexion with the other observations, by George W. Dean, Esq., under my immediate direction; those for azimuth with the 30-inch theodolite, by me personally, assisted by Mr. Davidson and Mr. Dean. In connexion with the determination of latitude, 323 observations were made with the zenith sector on 11 standard and 73 other stars, 174 observations with the zenith telescope by Talcott's method on 35 pairs of stars. For azimuth 52 observations were made on Polaris and delta Ursæ Minoris, near the eastern and western elongations, and 58 on the elongation mark. The same mark by day, and lamp by night, were used for the meridian mark for the transit, and for the elongation mark in observing azimuth. For time, in connexion with the foregoing, 101 transits were observed on 16 stars.

A meteorological register was kept at both stations by Mr. J. R. Smead, in which 249 observations of the Hassler standard barometer, and 226 of the aneroid barometer, were recorded, and 249 observations of the temperature and wet bulb hygrometer, besides miscellaneous observations of force and direction of wind, &c.

Vidi's aneroid barometer is so promising as a marine barometer, that I have taken some pains to keep up the comparison with the standard of one made in London. The results will be stated hereafter.

Observations for magnetic declination, dip, and intensity, were made at both stations—at the first by Mr. Dean, and the last by Mr. Davidson—the declination (variation) and intensity with declinometer No. 22, by Jones, of London, (C. S. No. 1.) The observations at Mount Independence were interrupted by frequent magnetic disturbances attending auroras. Sixty-nine sets of observations for declination on four days, three for intensity on two days, and three for dip on three days, were made at Pattuccawa, and eighty-six sets for declination on three days, three for intensity on three days, and three for dip on three days, at Mount Independence.

The work was closed, to proceed to section V for the measurement of a base line on Edisto island, near Charleston, on the 27th of October.

Magnetic observations were made at or near five secondary stations in this section by Professor George W. Keely, of Waterville College, Maine, for the charts of Lynnhaven bay, Marblehead, Salem, Gloucester, and Annisquam harbors. The instruments used were, for declination a unifilar magnetometer, by Jones, of London, in the possession of Professor Keely, and at the latter stations declinometer No. 22, by Jones, (C. S. No. 1.) The observations for horizontal intensity were made with the first named instrument, and for the relative total intensity with two Lloyd needles, with weights. For magnetic dip, a circle by Barrow, with compound microscopes, was used. The dip circle and the Lloyd needles, as well as the unifilar magnetometer, are those heretofore employed in his observations by Professor Keely. At Little Nahant station, 951 observations were made on four different days, including three sets for declination, (variation,) three for horizontal force, two for relative total force, and three for magnetic dip. At Fort Lee, Salem, the local attraction was found so considerable that, after observing in different positions near each other, the station was abandoned. Codden's hill (see sketch A, secondary triangulation near Salem) was examined for the same purpose, and the local attraction found also to be great there; and Baker's island was finally fixed upon for the full set of observations. Eight hundred and forty-one observations were made on four different days at this station, comprising three sets for declination, with declinometer No. 22, three for horizontal force, and two for dip. At Codden's hill, 217 observations were made on five different days for declination, with declinometer No. 22. At Beacon hill, near Gloucester, 1100 observations were made on six different days—namely, five sets for declination, with the unifilar, three for horizontal intensity, two for relative total intensity, and two for dip. The declination was also observed at Annisquam, on the north side of Cape Ann, and comparative dip observations to detect the local disturbance; which, however, was not found to exist.

The observations for difference of longitude between Cambridge and Liverpool, by the transportation of the chronometers of the British mail steam vessels of the Cunard line, have been continued by Professor W. Cranch Bond, who has furnished eighty-seven additional observations during the year. The difficulties attending the procuring, in an authentic scientific form, of the observations for time at Liverpool, and the consequent uncertainty introduced into the determinations, induced Professor Bond to propose to me, in the spring of last year, to undertake a special expedition, in which chronometers belonging to the survey, or hired expressly for the purpose, and arranged for the expedition, should be transported with special reference to it, between the observatories of Cambridge, Massachusetts, and Liverpool, England.

The general plan was matured in consultation with Mr. Bond and Assistant S. C. Walker, and the execution was confided to Mr. Bond. Mr. Hartnup, director of the observatory at Liverpool, entered with great zeal and assiduity into the plan, and has contributed most essentially to its success. All the arrangement for procuring and transporting the chronometers, and for their speedy and safe delivery on their arrival at Boston and Liverpool, have been made by Mr. Bond, with the kind assistance of Mr. Hartnup. The observers on the two sides have adopted, for the most part, the same Nautical Almanac stars in obtaining their local time; and the same forms of reduction and the personal equations have been obtained through Mr. Richard Bond, who made comparisons with the observers at Cambridge and Liverpool, and took charge of the chronometers in the first trip from England. The number of chronometers compared is forty-four, of which fifteen are by Fletcher, twelve by Dent, and the rest by other makers. These have been transported in the Cunard steam vessels under charge of their officers, being separated into sets for the purpose of varying the circumstances of the voyages, and of increasing the opportunities of observation soon after their arrival at each observatory within the limited season during which it was judged expedient to prosecute the expedition. It is proposed to resume operations as soon as the season again becomes favorable. The results already obtained are of decided interest, indicating a change in the longitude, as given by astronomical observations, of nearly two seconds of time.

Professor Bond has furnished observations of 18 occultations (12 immersions and 6 emersions) between the 1st of January and 27th of September, 1849. Several of these occultations were observed by more than one observer, the number of results communicated being 26.

Mr. Bond and his assistant, George P. Bond, Esq., also took part in the telegraphic observations for differences of longitude in January, July, and August last, when the records were made by the methods devised by J. J. Speed, Esq., and Dr. John Locke.

The astronomical observations at Nantucket for the use of the survey have been continued during the past year by William Mitchell, Esq., who reports 94 observations of transits of the moon, and of moon culminating stars; 8 occultations; 116 observations for latitude, with the prime vertical transit; and 120 meridian passages for time, with the West Point repeating circle.

A very interesting report of Professor O. M. Mitchell, of Cincinnati, on the mechanical record of astronomical observations, will be found in the appendix No. 5. Professor Mitchell gives a brief account of his first experiment on the 26th of October, in recording the successive seconds indicated by the pendulum of a clock upon a Morse telegraphic register, and of the experiments immediately following this; a more extended notice of his disk for recording right ascensions, one of the most perfect of the methods of registering now in use, and which was communicated to me in February, 1849, and indicates the degree of accuracy attained already by this method, and the saving of time which it effects in observations of right ascensions. The report then goes on to describe a mechanical method for registering differences of declination, which is in the highest degree ingenious, and the results of which are so directly applicable to our work, that I have induced Professor Mitchell to undertake by it the measures of the declinations of the small stars used in our zenith telescope observations.

SECTION II.—*From Point Judith to Cape Henlopen, including the coast of Connecticut, New York, New Jersey, Pennsylvania, and part of Delaware.*—(Sketch B.)

12. A thorough comparative examination of the specimens of the bottom, obtained in this section, has been in progress by F. Pourtales, Esq., under suggestions from Professor Baily and Professor Agassiz. At the date of Mr. Pourtales's report (September 29) more than seven hundred and fifty specimens had been examined, and the classified results of the physical characters and microscopic examinations entered in tables. A comparison has also proceeded, in connexion with this, of the descriptions affixed to the specimens when brought up, and they have been examined both wet and dry. In his report Mr. Pourtales remarks: "All the sand covering the bottom of the sea off Long Island and New Jersey appears to be composed of the constituent parts of granite or sienite, viz., quartz, feldspar, hornblende, and mica, quartz being always preponderant. The proportion of the other materials makes the difference of color. This difference in the proportion, together with the degree of fineness, varying from pebbles to mud, must be the result of a kind of winnowing process produced by the combined action of tides, waves, and currents."

The study of the distribution of the organic remains according to depth, which is the prevailing circumstance, is of great interest to the naturalist, and is readily deducible from that in progress by Mr. Pourtales for our special purposes. That this subject admits of a real application in the hands of navigators, will not be doubted by anybody who will take the trouble to look at the specimens of bottom containing these animal remains with a common pocket lens, or even a reading glass. Mr. Pourtales remarks: "The difficulty of using a compound microscope at sea had made me at first diffident of the practical utility of this study, but I find now that for all purposes, except those of the zoologist desirous of distinguishing sub-genera and species, a lens of small power, or even the naked eye, is amply sufficient."

After a few minutes bestowed on such an examination, by a person undertaking it for the first time, it is curious to see the interest which it excites, and the facility with which some of these specimens are recognized by the naked eye. Many of the species are so large that they can readily be picked out from among the sand with the point of a penknife. This thorough examination by one person will secure uniformity in our off-shore chart, and has already suggested more than one "remark;" and, in regard to the examination of the minute animal remains, "should there be any well characterized species circumscribed in a well determined space, and abundant in individuals, so as to give a good clue to navigators in regard to their position, the fact cannot escape being brought to light by the present mode of working."

SECTION III.—*From Cape Henlopen to Cape Henry, including the coast of Delaware, Maryland, and part of Virginia.*—(Sketch C.)

3. *Differences of Longitude by Telegraph.*—During the summer, observations were made for connecting the "Seaton Station" with Western Reserve College, so as to bring into use, for the longitude of our stations from Europe, the observations of moon culminations and occultations made by Professor Loomis at the Hudson observatory, and since reduced both by Professor Loomis and Lieutenant Gilliss. The instruments at the stations are automatic, on the plan of Joseph Saxton, Esq., registering on a metallic cylinder, or cylinder covered with paper, the circuit being made and broken by the pendulum of the clock.

Every facility was furnished by the Hon. B. B. French for using the telegraph line between Washington and Philadelphia, and by J. D. Reid, Esq., for the western telegraph lines—the local superintendents making great efforts to prevent interruption to our work from the consequences of the prevalence of epidemic cholera. The thanks of the survey are also due to the Hon. Elam Alexander, for his liberal offers in regard to the use of the southern line of telegraph, and to Henry O'Reilly, Esq., for the facilities which he has rendered to us on his lines. It will be a matter of great interest to reach New Orleans both by the western and southern routes, for which Cincinnati offers on the one side an intermediate station through the arrangements with Professor O. M. Mitchell, and Charleston on the south through those of Professor Lewis R. Gibbes.

The correspondence with Elam Alexander, Esq., President of the Washington and New Orleans telegraph line, is given in appendix No. 9. The same liberal spirit has been shown towards the coast survey by the directors of the western Morse lines, constructed by Henry O'Reilly, Esq. The thorough and cardinal co-operation on the part of the presidents, superintendents, and operators of the telegraph lines, greatly facilitates the connexion of the stations in longitude, and bids fair to furnish, in the end, a new and important element for the reduction of the work. It is not only the mark of a liberal but of a patriotic spirit pervading those who have connexion with these important agents of modern civilization.

The telegraph operations of the coast survey have furnished four independent series of observations for difference of longitude between the stations of Washington and Philadelphia, the latter and New York, and between New York and Cambridge. The facility of obtaining results by the automatic printing methods, and their superior accuracy, will enable us to add still further to the value of our determinations. The progress of the art has been so rapid, that it seems now almost perfect; and yet no doubt the appliances will be much improved as experience develops the minor defects, and ingenuity suggests the remedies. The present condition of the telegraphic lines themselves is such, that the difficulties increase very much with the length of the wire, from the differences of meteorological circumstances, some part of it being exposed to storms of rain or showers which break the connexion of the whole. Intermediate stations are thus of advantage, not only in consequence of the information in regard to the longitude of the places themselves, but as increasing the opportunities for telegraphic communication within a given period of time.

The art of telegraphic operations has now reached a point at which it becomes necessary to inquire whether the velocity of the galvanic current is susceptible of measurement. An attempt to determine this was made by Assistant S. C. Walker, in January last, the results of which were deemed of sufficient interest to be communicated (under approval of the Treasury Department) to the American Philosophical Society, and were printed in their proceedings. Previous to the introduction of the automatic printing method for the registering of the transits of stars, this element was insensible.

Section IV.—*From Cape Henry to Cape Fear, including part of the coast of Virginia and the coast of North Carolina.*—(Sketch D.)

1. *Measurement of Base.*—As stated in my last report, the measurement of the base, six and three-quarter miles in length, was commenced in November.

The base was alligned and approximately measured by Assistant C. O. Boutelle. The allignment was made by a Gambey theodolite, or by sectors made by Temple, pegs being driven and copper nails placed in them to mark the line. At every 400 metres a large peg was driven, and alligned with much care, so as to be used in determining the line in measuring, a tripod, with a heavy iron plumb-bob suspended by a cord, being placed over these marks.

The base was measured by the compensating apparatus planned by me, and executed in the office of the survey by Mr. Würdeman. Its peculiarities have been described in a former report. Its length was invariable at different temperatures, and through changes of temperature. The apparatus was compared in length with the standard iron bar before the measurement was commenced, when near the middle of the base, and after closing the measurement. Two hundred and sixty-one observations were made on six different days for this purpose, at temperatures varying from 67°·2 to 33°·9, a portion of them being as near 32° as could be obtained. The measures were very accordant in their results. In making these observations, the apparatus was placed between two stone posts, plumbed in wooden boxes without top or bottom, which were sunk in the sand to the depth of nearly three feet; the knife edge at one end pressing against the plane end of a short cylinder, and the agate plane at the other against a point turning a mirror, as in Mr. Saxton's pyrometer. The reading telescope and scale were attached to a post opposite to that last referred to. The steadiness of the posts was quite unexpected, the results being superior to those obtained previously in the office.

The measurement was commenced on the 4th and completed on the 23d November, the weather having been moderately favorable in the interval. Ten days were employed in the actual measurement.

At the end of each day's work, three heavy pieces of timber or blocks of stone were placed under the ends of the tubes, and marks made on them corresponding to as many measures, the marks being made by the assistance of the sectors, or of a 6-inch Gambey theodolite. At the ends of the tubes nearest to the several miles, stone posts were sunk, with copper bolts inserted and duly marked. The measurement was begun at the north end of the base, and both extremities were secured by granite posts resting upon a stone foundation, and this upon a platform of timber below the surface of the water, which is generally found here at less than three feet distance below the ground. The actual extremity is marked by a copper nail in a cedar stake driven in the axis of an earthenware frustrum of a cone, and corresponding to which is a hole in the platform. In the heavy stones forming the foundation a copper bolt marks the same point. The prolongations of the base, and a perpendicular to the ends, have been marked by posts with copper bolts, and pains have been taken to secure the monuments at the terminations.

The facility of measurement on this site, from its level character, was very great, and if it is not secure from the invasions of the ocean or sound, it is at least as secure as any level part of this coast. A few parts of the line where grading was required through low sand hills or in hollows, had been prepared previous to commencing the measurement, or were graded at intervals during its progress.

The trestles supporting the tubes of the base apparatus were placed upon iron plates resting upon the surface of the sand.

The least distance measured in any one day was 528 metres in $5\frac{1}{4}$ hours, and the greatest was 1692 metres (1·06 miles) in $8\frac{1}{2}$ hours. In the work generally I was assisted by Assistant C. O. Boutelle, who directed the forward tube; in making the contacts in measuring, by Sub-Assistant J. Hewston, Jr. The allignment was preserved by Sub-Assistant Joseph Ruth. The trestles were set by T. McDonnell, Esq. The records were made by Mr. B. H. Duncan. In preparing the apparatus for comparison of lengths with the standard bar, and in making such incidental repairs as were required, Mr. J. Clark, of the office of weights and measures, rendered valuable service.

After the measurement was made we repeated part of it on a portion of the line, which admitted of stakes being permanently placed below the extremity of each second tube, for comparison. The length of twenty-two tubes was then remeasured four times, making in all about one-third of a mile. The probable error thus found for the whole length of the base, (1807 tubes,) or nearly $6\frac{3}{4}$ miles, was less than one-tenth of an inch. On the hypothesis in regard to these repetitions most unfavorable to the accuracy of the measurement, the error for the whole length was less than three-tenths of an inch. The circumstances being somewhat unfavorable to the first day's measurement, it was repeated, and the second measurement of 88 tubes (about one-third of a mile) differed less than $\frac{1}{200}$th part of an inch from the first.

To be Continued.

On the Construction of Arches with Hollow Cast Iron Voussoirs.[*]

In the construction of cast iron bridges, it has generally been the practice to form a framework by means of ribs stretching across the full span in one or more pieces, in the form of an arch or otherwise, which ribs are stiffened or kept steady by transverse beams, diagonal struts, and ties; thus adopting, to a certain extent, the system followed in the construction of many of the wooden framed bridges, previous to the introduction of iron in being wholly used for such works. This, no doubt, is a very excellent mode of construction; but it is considered that, by adopting the system of stone bridges, and having the voussoirs formed of cast iron and hollow, a cheaper and easier constructed bridge could be erected, while the principle is one which possesses many peculiar advantages, and admits of being applied not only to arches of small, but also to those of very large spans.

In the framed system, the ribs, beams, &c., are generally very heavy, require much workmanship in their construction, are difficult to cast, and after good castings have been obtained are very liable to be damaged before being put in their places; thus causing the reconstruction of other castings, and consequently adding much to the expense, on account of the risk and delay. By the proposed system the castings become of an ordinary nature, require less workmanship, are easier constructed, very light and easily handled, and run less risk of being damaged; and even when a number of the voussoirs were damaged, the contingent expense would be very little compared to that arising from the loss caused by the damage of a large and massive beam. Such castings are consequently cheaper executed, the cost per ton for the same kind of castings being frequently not much more than one-half that of the other; besides, by a judicious arrangment and economy, no more, or at least very little additional, metal need be required by the proposed than by the framed system.

Both in ancient and modern times, hollow bricks have been used in the construction of arches, especially where lightness was required, and no great weight to be sustained, as these bricks were liable to be easily crushed. With cast iron this is, however, not the case, it being to a very great extent incompressible, the crushing weight for a square inch of cast iron being 140,000 lbs., while good stock bricks require only 12,000 lbs. to crush it, and in stone the crushing weight varies, according to the quality, from 3166 lbs. to 6250 lbs. per square inch. Since hollow bricks have been successfully employed, it is easy to conceive that hollow voussoirs formed of such a hard and incompressible material as cast iron, may likewise successfully be employed, not only for arches of a small, but also for those of a very large span.

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[*] From the London Civil Engineer and Architect's Journal, for June, 1850.

It is now an established principle, that when the materials of which an arch is composed are hard enough to resist compression, and the abutments sufficiently strong to resist being crushed or forced aside, there is no particular limit to the extent to which, if properly constructed, the span may not be carried. Of course, no substance being incompressible, it follows that there must be a limit beyond which the arch would destroy itself, but that limit will be greater or less according to the hardness of the material employed in the construction. An arch constructed of granite is capable of being carried to a greater span than one of good freestone, and still more so than one of freestone of an inferior quality, or of brick not sufficiently fired. And following out the same principle with hollow cast iron voussoirs, a still greater span could be accomplished than with any of these other materials.

Besides the advantage of cast iron voussoirs, on account of its extreme hardness, it possesses another advantage, that of lightness, these voussoirs being capable of being made sufficiently lighter than the same constructed of stone, and still retain sufficient strength to resist the required pressure. The weight of material in a cast iron arch would be from $\frac{1}{4}$th to $\frac{1}{5}$th that of a stone one, supposing the depth of the voussoirs was made the same in each, which however would not always be necessary, as when constructed of iron less depth would be sufficient, on account of its extreme hardness, the weight being so considerably diminished, and the pressure being more uniform over the entire surface of the joint: the surface of castings being much smoother and evener than that of an arch stone, which, except in very particular cases, is generally only neatly hammer dressed.

Again, in the framed system usually adopted, the pressure is thrown on a very small surface, which is not the case in the proposed system; likewise the use of malleable iron is entirely avoided, it being purely a cast iron arch, every part of which contributes its due proportion of resistance, forming a firm and compact mass, and possessing all the advantages of a stone arch.

Taking into consideration these many advantages—namely, the extreme hardness of the material employed, the decrease of weight and the superiority of the joint compared to stone arches, and the large extent of bearing surface compared to that of the framed system, it is surely not unreasonable to say that an arch on this principle may not only be carried to a greater extent than any hitherto constructed of stone, but equally as far, and perhaps further, than any that have yet been constructed of iron on the framed system. In the Grosvenor Bridge, across the River Dee at Chester, a stone arch has been successfully thrown over a span of 200 feet; and in the Southwark Bridge, across the Thames at London, which is formed of cast iron on the framed principle, the centre arch is carried to the extent of 240 feet; but with hollow cast iron voussoirs, an arch equal and even exceeding either of these spans may be executed with safety.

In the construction of an arch upon this principle, it is proposed to have a raised piece cast on the side of each voussoir, fitting into a corresponding hollow on the one adjoining. By this means the whole becomes more firmly joined together, forming, as it were, a series of joggles throughout the whole structure, and entirely preventing any tendency of the arch to rise at the haunches, or of any of the voussoirs to slide. This is a very important advantage, and one which, in an iron arch, can be easily obtained with little or no additional expense.

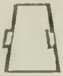

Fig. 1.—Transverse Section of Voussoir.

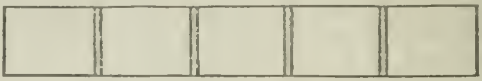

Fig. 2.—Transverse Section of Arch.

The form of the voussoirs may either be made similar to those in stone bridges, with the addition of these projections and hollows, (see figs. 1 and 2,) or, where additional strength is required, they may be executed according to fig. 3.

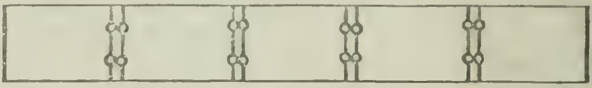

Fig. 3.—Transverse Section of Arch.

On account of the voussoirs being all firmly fixed to each other by means of the joggles already mentioned, it would not, on all occasions, be necessary that they be placed close to each other at the ends, but kept a little separate, as shown in fig. 4. By this means, while the arch could still be made sufficiently strong, a considerable saving of material would be effected.

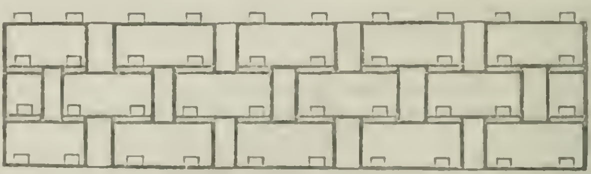

Fig. 4.—Plan of part of Arch.

As to the thickness of metal required for small and medium spans, the average may be from $\frac{1}{4}$ to $\frac{3}{4}$-inch, and for large spans one inch would be sufficient for the average, care being taken that the ends of the voussoirs be made thicker than the sides. In order still further to strengthen the ends without requiring additional metal, the sides may be made slightly open.

In places where stone cannot be easily obtained, bridges could be constructed on this principle at a very moderate cost, while they at the same time would be both substantial and durable. The spandrils and abutments may be constructed of such materials as could be most readily obtained, and which was considered suitable, as such bridges admit of being finished similar to a stone one or otherwise, according to the taste of the projectors and resources of the locality.

On the Application of Water Pressure, as a Motive Power, for working Cranes and other kinds of Machinery. *By* MR. W. G. ARMSTRONG, *F. R. S., Assoc. Inst. C. E.*[*]

The object of the paper was to direct attention to the advantages of a more extended application of hydraulic pressure as a motive power, and to point out the means of attaining this desirable end; illustrating the arguments by descriptions and drawings of the engines on this principle already erected since the year 1845, when the author first designed a crane to be worked by the pressure of water from the street water pipes, at Newcastle-upon-Tyne.

The principle of these engines, as applied to cranes, was described to be very simple. In order to lift a weight, the water, under a pressure of about 100 feet head or more, being admitted through a slide valve into a cylinder, exerted a force on a piston, whose rod was connected with the hoisting chain, so arranged by passing over several pulleys, as to increase its length of travel to the requisite duty to be performed; the piston receding from the pressure therefore raised the weight to the height required. The lowering of the weight was accomplished by a reverse action, and the crane was turned in either direction by a similar action of a smaller cylinder, whose piston rod was connected with a rack, working into a circle of teeth, fixed to the base of the movable frame of the crane.

The action of these machines was described to be very smooth and steady, ingenious appliances being adopted for obviating the shock that would otherwise be caused by the sudden closing of the slide valves, and all the different operations being under the perfect control of a few regulating handles. In cases of a great diversity of power being required separate cylinders were used, so arranged as that their action could be combined according to the force required. The speed of working had no other limit than the size of the supply pipe.

Allusion was made to the advantage of employing hydraulic pressure in mercantile docks, for hoisting heavy weights, for whipping light goods out of ships, and for opening and shutting dock gates, swing bridges, and sluices. Its facility of transmission, its safety, and constant readiness for use, rendered its peculiarly suitable for these purposes. It would generally be preferable in such cases to employ steam power to force the water, rather than to be dependent upon town water works; and a tank upon a tower, or upon an eminence, would form a convenient magazine of power, enabling the engine to act continuously with an uniform load. Large air vessels had also been successfully employed instead of an elevated tank.

Hydraulic pressure might also, in many cases, be advantageously employed for purposes requiring continuous rotation. There were many natural situations where mountain streams might be arrested, or surface water be impounded on elevated ground, and be conveyed by a pipe into a neighboring valley, where great mechanical efficiency might be derived from a small supply of water by the use of water pressure engines. In mining operations, also, the danger and inconvenience of underground steam engines might be obviated by substituting water pressure engines, conveying the water down the shaft in pipes, and returning it to the surface, by the action of the pumping engine above ground. In such cases the water was merely the vehicle for transmitting power into the mine.

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[*] From the London Civil Engineer and Architect's Journal, for June, 1850.

A water pressure engine had been lately very successfully applied by the author in South Hetton Colliery, for the traction of wagons upon an underground railway. Similar engines had also been erected in the lead mines at Allenheads, for lifting ore and other purposes. Reservoirs were there formed upon the neighboring hills, and pipes were carried into the mines to supply the engines, the expended water flowing out by a level. Other engines of the same description were also in course of erection, for surface operations, at the same place, such as crushing ore and raising minerals from the shafts.

In their general character, these engines were similar to reciprocating steam engines. The slide valves were balanced by equal pressures in opposite directions, and were constructed to open very spacious water passages. The liability to concussion, on the closing of the eduction port, was obviated by the application of relief valves, which were lifted by the compressive action of the piston, causing it to act for an instant as a pump, in forcing back the opposing water into the supply pipe. In cases where the engines had been applied to hauling or winding, four cylinders placed diagonally in pairs had been used. In other cases two cylinders had been applied, the uniformity in the motion of the column being maintained by a loaded plunger. The winding engines were reversed by a slot link apparatus, similar to that of a locomotive engine, and which was worked by the pressure of the water, acting under the control of a valve. The regulating and reversing valves were each placed at the mouth of the shaft, at a distance from the engine, the operation of which could thus be directed with great accuracy and safety.

The drawings which accompanied the paper gave representations of an hydraulic crane, for shipping coals at Glasgow; hydraulic platform cranes, at the railway station, Newcastle-upon-Tyne; hydraulic hoisting machines, at the warehouses of the Albert Docks, Liverpool; a water pressure engine for a crushing mill at Allenheads; a similar engine used at the same place for winding, and numerous details of all these machines.—*Proc. Inst. Civ. Eng.*, *May* 7, 1850.

Steam Haulage on Rivers and Canals.[*]

An experiment has lately been tried, with complete success, on the Gloucester and Berkely Canal, of a somewhat novel steam tug for hauling vessels instead of horse power. It consists of a continuous flexible rail or bar of iron running the whole length of the canal, and made fast at each terminus. Above the deck of the tug are fixed a pair of rollers, between which this flexible iron band is placed, and as they are made to revolve by the steam engine on board, the grip which they take propels the boat. On the trial in question, after hauling various small craft of from 70 to 80 tons burden, she took in tow a Greek brig, laden with corn to the amount of 350 tons, which she towed against a head wind to the dock entrance, at a good walking pace. She hauled the common canal boats at a rate of 6 miles an hour, the speed being but little affected when going against tide. The cost of hauling in the Severn is a heavy item in the transit of goods, and this invention is calculated to diminish the expense 50 per cent., the consumption of coal being only 25 lbs. per hour.

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[*] From the London Civil Engineer and Architect's Journal, for June, 1850.

Steam Engine Economy. *By* Robert Dempster.*

As one great object of the *Practical Mechanic's Journal* is the recording of facts in science and art, may I solicit for myself a corner in its pages, for the purpose of making known some economical arrangements which I made upon a steam engine in the fall of 1847? The engine in question is a low pressure condensing beam, with slide valves of the ordinary D kind; diameter of cylinder, 26 inches; stroke, 5 feet. It has two steam chests—one at each end of the cylinder, connected by a pair of columns, one of which acts as the steam pipe, whilst the other contains the exhaust passage; the whole exterior having the appearance of a piece of architecture of the Tuscan order. The D valves are made and packed in the usual manner, and the state in which I found them was as under:—

Width of ports, ...	3½ inches.
Length of ports, ...	11½ "
Breadth of valve faces, ...	3¾ "
Cover on steam side, ...	⅜ "
Exhaust being ⅛ inch uncovered.	
Stroke of valves, ...	8¼ "

The alteration upon them I effected by the addition of a piece of brass to the steam side of each valve, with a change in the length of their connecting rod, and they are now in the following condition:—

Breadth of faces, ...	7 inches.
Cover on steam side, ...	2¾ "
Cover on exhaust, ...	¾ "
Lead, ...	⅛ "

The state of the valves at the extremity of their stroke is—

Bottom edge, opening on steam side, .	1 3-16 inches.
" " exhaust, . .	3 3-16 "
Upper edge, opening on steam side, . .	1 5-16 "
" " exhaust, . .	3 5-16 "

The difference of opening on the opposite sides arises from the angles formed by the connexions. With this arrangement, the valve cuts off the steam at three inches past the half stroke of the piston, and the expansion continues from this point up to four inches from the termination of the stroke; and at this time the exhaust port is two inches open.

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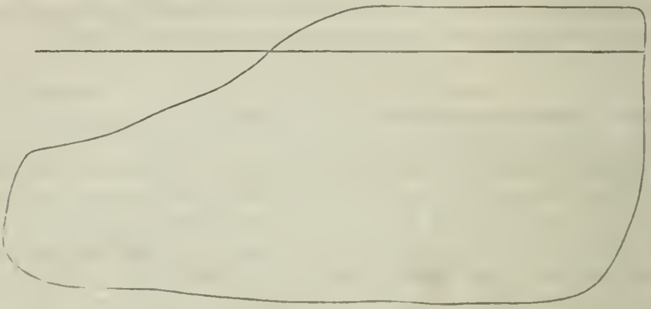
* From the Glasgow Practical Mechanic's Journal, for June, 1850.

On the return stroke the valve closes the exhaust. When the piston is 11 inches from the end of the stroke, at the bottom of the cylinder, the piston has a clearance of $1\frac{1}{8}$ inches, and at the top $1\frac{1}{2}$ inches. Supposing the semi-revolution of the crank to be divided into 180°, steam enters the cylinder during the performance of 94°, expands during 56°, and throughout the remaining 30° the steam is open from the cylinder to the condenser, so that the steam has allotted to it about one-third the time to rush out that it has to rush into the cylinder.



The annexed diagram was taken from the cylinder after the alteration, when in the regular course of duty. It is clear evidence of the correct action of the valves, and must be considered in connexion with the fact, that the expansion is entirely accomplished by the ordinary slide valve, with a face on the steam chest rather bad than otherwise.

The boiler pressure was 3 lbs., the diagram showing $2\frac{1}{2}$ lbs. with a vacuum of 13 lbs., the speed of the piston being 290 feet per minute. In the *Practical Mechanic and Engineer's Magazine*, vol. iv. 1845, you will remember I advocated the adoption of increased speeds in conjunction with high expansion, and I think the case before us is a tolerable exposition of the truth of my views. When the engine was first set to work, it was calculated for the old rate of 220 feet, but it has been shown that it might even run much faster than its present rate of 290 feet. Previous to the alterations I have described, complaints were made of the occurrence of shocks on turning the centres. Now, nothing of this sort ever takes place, although the valve faces are perfectly parallel on the edges, and open the ports directly across at once.

Some engineers are in the habit of putting *curved* lap-pieces on the steam side of the valves, in order to wiredraw the steam on its first entering the cylinder, so as to avoid the shock, or soften the action, of the entering steam upon the piston. Now the best examples of modern stationary engines get their steam instantaneously by means of conical, equilibrium, and many other kinds of valves; and I am led to believe, from my own actual experience, that the slide valve, with the usual straight outline, is already sufficiently defective as a wiredrawing valve, without making it still more so by these shifts. It has been stated that the curve has been introduced to avoid *flushing*—that is, an unsteady foot-lathe-like motion, experienced when expansion is carried too far. This objectionable action, which is most injurious in spinning establishments, is, I suspect, rather to be traced to the sluggish movement of the piston—an allegation which, until very lately, few engineers would admit.

The fact of the closing of the eduction port when the piston is 11 inches from the end of its stroke, in the engine to which reference has been made, may perhaps be termed an unavoidable evil. Unavoidable it is, but how far the evil goes remains to be seen. The diagram shows that the pent-up steam does not reach the atmospheric pressure, there being the clearance and ports to fill. On the other hand, whatever shutting-up action does occur, would appear only to affect the smoothing of the reverse motion of the engine. In starting the engine, much difficulty is experienced in getting over the first centre, owing to the lap on the steam side, and the two-inch lead on the exhaust; but once over, if the vacuum is tolerable, there is no more trouble.

The Boiler.—The boiler is of the common wagon shape, 21 feet long, with an internal flue. The heat, after traversing the bottom, returns along the internal flue, splits in front, and passes back again along both sides of the boiler, finally entering by the damper into the chimney. The heating surface is made up as follows:—Bottom of boiler directly exposed to the action of the fire, 27·5 square feet; bottom behind the bridge, acted on by carried heat, 88 feet; central flue, 149·1 feet; side flues, 168 feet; front end, exposed to carried heat, 13 feet; back ditto, 5 feet; total, 450·6 feet. The length of the heat's travel is 63 feet; originally the furnace bars were 18 inches below the highest part of the boiler bottom, and the furnace projected so far forward that the first three feet of the boiler appeared to get the greatest radiating heat from the incandescent fuel. Retaining the original area of furnace, it was led back 22 inches farther under the boiler, lowering also the furnace bars to the depth of 12 inches, so that their level was made 2 feet 6 inches below the boiler. In this re-arrangement every part of the furnace is covered by the boiler, the frame of the furnace door being built in below the angle iron of the boiler end, so that the door, when closed, stands in a line with the boiler end. The present dimensions of the furnace now are—Length of bar surface, 5 feet; breadth, 4·3 feet; making an area of 21·5 square feet. Its mean height being 2 feet, its capacity is equal to 43 feet.

The space under the boiler, from the furnace backwards, was made of considerable capacity, and the bridge was built up in every part to 4 inches from the boiler bottom. The area of the throttling-place is about one-fourth that of the internal flue, so that the current passes this part at its highest rate of velocity. The use of this throttling action I may here shortly discuss.

The fire is kept as thin as possible, and generally, notwithstanding the attention of the fireman, a quantity of air must always pass through the grate, without a chance of combination with the incandescent fuel; and in addition, the heat continually sets free the volatile gases of the fuel. Much of the carbon also passes away as carbonic oxide. This waste goes on to its fullest extent when there is a tolerably thick bed of half-burnt fuel on the bars. Without the application of some remedial agent, each product would get away in its independent state, but the throat answers the purpose of forcing together and mingling the gases, turning the whole mass to account.

The bridge is always at a great heat, and at periods when there is little smoke distilling, the action of the fire upon it raises its temperature to the maximum, and when a fresh charge of fuel is applied this heat is to a considerable extent liberated, and taken up by the smoke and passing vapor. The heat thus partly acquired from the bridge renders the vapor fitter for combination, and the object of the large space behind the bridge is to allow room, so that the current may pass away at a slower rate.

As respects the quantity of air to be admitted to the furnace, if the fire is kept very thin, the necessary quantity will always find its way through; but if at any time too little should be thought to be passing through, a remedy is easily provided in leaving a portion of the bars uncovered. With such an arrangement, coupled with moderate attention on the part of the fireman, it is possible to prevent the escape of visible smoke; but the avoidance of all smoke does not, in this plan, act so economically as when a little smoke escapes at charging or stirring the fire.

I had no means of accurately measuring the quantity of water evaporated by a given quantity of fuel, so as to give the economical value of the boiler; and no one is justified in condemning any form or setting of the boiler before its evaporative powers are ascertained. I cannot help condemning the practice of estimating the qualities of engines by the pounds of coal consumed per horse-power per hour. The question should be—how many cubic feet of water, at a given temperature, does one ton of a certain fuel evaporate from the boiler, and in what time? And for the engine—how many pounds are raised one foot high by each cubic foot of water evaporated? at what initial pressure does the steam enter the cylinder? and at what point is it cut off?

Some method of this kind will keep separate the merits or demerits of the engine and boiler, and a fair estimate may be made of the qualities of each. In the example I have given, the modifications on each were effected at the same period; and the result is, that 26 cwt. of fuel now goes as far as 39 cwt. did before.

To effect the perfect combustion of the gases derived from coal, it appears to me that the following points should be attended to:—

1st, That abundance of air be admitted amongst the burning fuel.

2d, That the air be caused to enter the furnace to *some extent*, without passing through the incandescent fuel.

3d, That the air and gases be prevented from losing heat before the atoms of gas and oxygen from the air have had time to combine chemically.

4th, That, to obtain the last desideratum, the products of combustion should for some time be shielded from the cooling action of the boiler.

5th, That, to effect this, it appears to be necessary to form a large space behind the furnace bridge; in fact, a space of a sectional area equal to that of the boiler, the flame to enter this space near the bottom, and the said space to be enclosed with brickwork, to prevent radiation.

6th, That the boiler be made conical, like a sugar-loaf; the side next the ground to be set horizontally, or even to dip somewhat towards the small end; with such a contrivance the steam would not reach far back in the boiler, and with the cold water introduced at its small end it would not instantaneously rob the warmer portion of the water of its heat.

The fire is supposed to be at the large end, as also the steam chamber. No return flue is required, as the boiler is presumed to be made long enough without it. This boiler would have the greatest heat of furnace where the hottest water is required, and as the products of combustion pass onwards to the small end of the boiler they diminish in heat, and in like manner the boiler will diminish in heat, until, at the small end of the boiler, the heat will be about the same as that of the injected water. Here, then, is a most simple arrangement for robbing the products of combustion of their last particle of heat. The taper of the boiler may run out as small as it is possible to make it, or keep it clean, and its length is indefinite.

Blairgowrie, May, 1850.

AMERICAN PATENTS.

List of American Patents which issued in July, 1850, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improved Method of Fitting the Bows of Vessels;* Benjamin Barstow, City of New York, July 2.

The patentee says,—"The nature of my invention consists in making the cutwater of greater thickness or breadth than the forward part of the stem, to leave a space by each side for the receiving of sheathing timber, to cover and protect the forward part of the outer planking, and which also admits of giving better lines for the passage of the bow through the water."

Claim.—"What I claim as my invention, is making the rear edge of the cutwater to project on each side of the stem, to form a recess on each side, substantially as described, in combination with the sheathing pieces which fill up such recesses, and which cover and protect the ends of the plankings, and which also admit of giving better lines for the passage of the bow of the ship or other vessel through the water, substantially as described."

2. For an *Improved Method of Distributing the Air over the Heating and Cooling Surfaces of Air Engines;* Ernst Buckup, City of New York, July 2.

The patentee says,—"The nature of my invention consists in some improvements in hot air engines, whereby a greater economy of working is obtained, and also greater durability and efficiency are insured to the apparatus.

"My improvement consists in applying the inner plates to the hot air cylinders, to insure a more equal distribution of the heat, and also, by causing a current to pass over the heating and cooling surfaces, the liability to injury is greatly lessened."

Claim.—"What I claim as my invention, is causing the air, entering or leaving the cylinder, to pass over the heating and cooling surfaces in a thin stratum, by means of the plates or their equivalents, substantially in the manner and for the purpose set forth."

3. For an *Improved Sash Stopper;* Charles C. Cameron, Harper's Ferry, Jefferson county, Virginia, July 2.

Claim.—"What I claim as my invention, is the triangular-shaped double acting wedges or fasteners, placed within recesses of corresponding shape formed in the front or rear sides of the sash side bars, or in the side slats of a window frame, acted upon by any kind of handles or levers, in such a manner that they will press the sashes inwards or outwards, (in contradistinction to sideways,) and thus retain them in any desired position, and render them airtight within the window frame."

4. For an *Improvement in Straw Cutters;* Reuben Daniels, Woodstock, Windsor county, Vermont, July 2.

Claim.—"What I claim as my invention, is the method of feeding straw, fodder, and other substances to a series of rotating cutters, by means of a continuous motion by a roller armed with pointed teeth and hung in a swinging frame, substantially as described.

"I also claim the method of cutting straw, fodder, and other like substances by means of the cutting cylinder provided with cutters, the outer faces of which, from the cutting edge, are curved or inclined in towards the axis, so as to admit of continuous feed, the blades of the cutters acting as gauge plates for the length of the cut of the cutters, in combination with the feeding of the straw, fodder, or other substance to be cut, by a continuous motion, substantially as set forth."

5. For an *Improvement in the Feeders of a Straw Cutter;* John E. Erb, Baltimore, Maryland, July 2.

The patentee says,—"My invention consists of a new combination and arrangement of devices, which, together, constitute a machine for cutting ears of corn, cork-stalk, straw, and other fodder, at once simple, efficient, and durable."

Claim.—"What I claim as my invention, is the guard-piece, in combination with the feed rollers, to carry the straw or other material to the cutters, as described."

6. For an *Improvement in Setting the Teeth on the Concave of a Clover Thresher;* Jonathan Hibbs, Bristol, Bucks county, Pennsylvania, July 2.

The patentee says,—"The said improvement consists in so setting the teeth of the concave that there shall be a slight degree of elasticity given to them, so that they move out of the way of any stones, &c., which may accidentally get into the machine along with the clover, and after the obstruction shall have passed the tooth returns to its original position, without suffering injury by its passege."

Claim.—"What I claim, is the right to use and manufacture machines for the purpose of threshing and hulling clover and other seeds of a similar nature, having the teeth of the concave, or the stationary set of teeth, so inserted in leather on a bed of cork, as to give them an elasticity sufficient to cause them to resume their original position when misplaced by the passage of any foreign substances which may be introduced by accident or otherwise into the machine."

7. For an *Improvement in the Cutters and Rakers of a Grain and Grass Harvester;* Hazard Knowles, Washington City, D. C., and Henry C. Bevington, Holmes county, Ohio, July 2.

Claim.—"What we claim as new, is, 1st, making the pointed cutters concave on the faces toward each other, in the manner and for the purpose set forth, by which the cutters are rendered self-sharpening and bending the upper plate over the back of the lower or sliding cutter plate, and bringing the notched or turned edge against the lower plate, in the manner and for the purpose described.

"2d, The arrangement of the stationary cyma-reversa fingers, in combination with the vibrating hook teeth or claws, bands, and the appendages for operating the same, by which the grain is collected into sheaves or gavels before being discharged upon the ground.

"3d, The combination of the hook teeth or claws, rock-shaft, bent arm, lever, spring, and revolving arm, for arresting the grain whilst removing the gavel or sheaf from the cyma-reversa fingers on to the ground; as described.

"We likewise claim the combination of the pinion, perch, and axle, the former working into the segment on the front axletree, for steering the forward part of the frame and cutters."

8. For an *Improvement in Respiring Apparatus;* Benjamin J. Lane, Cambridge, Middlesex county, Massachusetts, July 2.

Claim.—"What I claim as my invention, is the valve made of any metallic substance, and the nose-piece having an air-tight tube surrounding that part which is designed to fit about the nose, to accommodate the features of any person; and the use of these, together with a cylinder, vessel, air chamber, or bag, for the purpose of enabling a person to breathe, with perfect ease, air which has been condensed more or less in any such cylinder, vessel, air chamber, or bag, which is to be confined to the person of the wearer while the surrounding air is impure from any cause."

9. For an *Improvement in Collimating Levels;* John Locke, Cincinnati, Ohio, July 2.

Claim.—"What I claim is the mode substantially as described, of forming a leveling instrument by combining the spirit level with the collimator having a partial lens, viz., by means of a partial reflector, so placed as to reflect both the cross-wire and the spirit level bubble; in such manner that the image of the latter may be seen bisected by the image of the former when the instrument is horizontal, the image of the cross-wire being at the same time seen in optical contact with the distant point which marks the level with the observer's eye."

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10. For an *Improved Re-Immersing Amalgamator;* Joseph R. Miller, Fredericksburg, Spottsylvania county, Virginia, July 2.

Claim.—"What I claim as new, is the combination of the revolving basin, and its attached tubes or spouts, with the trough containing mercury, the tubes having sufficient length to force the issuing currents to the bottom of the mercury, or nearly so, and their discharging orifices being above the surface of the mercury, which latter peculiarity causes the streams, as they pass and enter in succession, to force below the surface any particles of metal which may not have been amalgamated by the first immersion."

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11. For an *Improvement in the Seeding Apparatus of Seed Planters;* Lewis Moore, Bart, Lancaster county, Pennsylvania, July 2.

The patentee says,—"One characteristic of my invention is the attainment of a uniform and steady distribution of the seed by means of oblique slots in the sliding gauge or feeding plate, in connexion with slots in the grate plates beneath the floor of the hopper, whose sides are either parallel with those of the hopper, or of different obliquity to those of the gauge apertures.

"Another common defect in seed planters exists in the absence of any ready control over the feed while the machine is in motion; and in order to get rid of this defect, I cause the motion of the gauge to be communicated by a rod terminating in a hook convenient to the hand of the operator, and which, by being inserted by him into any one of a set of holes at varying distances from the centre or fulcrum pin of a vibrating bar, any desired rate of feed can be attained, or, by abstracting the hook, can be temporarily suspended when the machine is passing over ground not intended to be sown, or in turning the machine at the end of the furrow; and all this can be done without arresting or altering the speed of the team."

Claim.—"What I claim as my invention, is, 1st, the employment of a reciprocating sliding guage plate, when said plate is provided with oblique feed openings, in combination with openings in the grating plates of different obliquity, and bottom of the hopper, for increasing or diminishing the quantity of seed to be sown while the machine is in motion, by adjusting the end of the connecting rod nearer to, or farther from, the fulcrum of the vibrating bar, and thus increasing or diminishing the traverse or sliding movement of the gauge plate.

"2d, I also claim the combination of the hooked connecting rod, arm, vibrating plate provided with a series of holes, (arranged in the arc of a circle scribed from the pivoted end of the rod,) and undulatory cam, with the reciprocating sliding gauge plate, by which the reciprocatory movement of the sliding gauge plate is regulated for the purpose of increasing or diminishing the feed or sowing of the seed."

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12. For an *Improved Lock Bolt for Shutters;* Joseph Nock, Philadelphia, Pennsylvania, July 2.

Claim.—"What I claim as new, is the bolt having a slot through which the key passes, which will admit the bolt to be moved back sufficiently far to prevent the spring catches from catching in the notches in the bolt, in combination with a key guard, which renders it necessary to remove the key before the shutters can be opened, substantially in the manner and for the purpose set forth."

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13. For an *Improved Arrangement of Cutters in a Grain and Grass Harvester;* Jacob Peirson, Wilmington, Delaware, July 2.

Claim.—"What I claim as new, is, 1st, the arrangement substantially as described, of cutters bolted to an endless belt, revolving in a vertical orbit, and moving on a rail guarded and disposed after the manner described."

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14. For an *Improvement in Machines for Cutting Lozenges;* John W. Pepper, Salem, Essex county, Massachusetts, July 2.

Claim.—"What I claim, is the adjustive spring fingers connected to the two wheeled car, said car being appended to the axle of the revolving cutters; the wheels and the screws that fasten the finger plate to the transverse bar preventing the finger plate from touching the sheet of paste during the operation of cutting the lozenges, as fully set forth."

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15. For an *Improvement in the Construction of Cooking Stoves;* S. H. Ransom, Albany, New York, July 2.

The patentee says,—"My invention consists in casting the fire bottom and front hearth, or summer arrangement. in one piece, by making the connecting part inside of the front plate of the stove, that the lower edge of the said front plate may be fitted directly on to the hearth plate, the inclination given to the connecting part for the draft in moulding, being thereby carried inside of the front plate; and also in combining this with the fitting of the said hearth plate with the bottom plate of the stove, and with the front edge of the bottom oven plate, by rebates or their equivalents, the fire bottom being extended under the lower edge of the fire back. with which it makes a good joint, the greater weight of the part in front of the stove tending constantly to keep this joint tight. And also in combining the manner of forming the said hearth and fire bottom, in combination with projections on the inner surface of the front plate, which bear against the inclined surface of the front part of the connexion between the hearth and fire bottom."

Claim.—"What I claim as my invention, is making the fire bottom and front hearth, or summer arrangement of the class of stoves herein specified, in one piece, connecting the two with inclined plates placed within the front plate of the stove, substantially as described, whereby I am enabled to have the hearth below the level of the fire bottom, whilst the inclination given to the connecting parts is not visible, thereby effecting the purposes specified.

"I also claim the above method of making the hearth and fire bottom, in combination with the method of connecting them with the oven bottom and stove bottom by means of tongues and grooves, whilst the fire bottom extends under the fire back, substantially in the manner and for the purpose specified.

"And I also claim, in combination with the above described method of making the hearth and fire bottom, the extension of the front stove plate down in front of the parts which unite the hearth and fire bottom; the said front stove plate being provided with projecting pieces to rest against the inclined joints, to aid in securing in place the said united hearth and fire bottom, substantially as described."

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16. For an *Improvement in Safety Tubes for Lamps;* Franklin Stewart, Philadelphia, Pennsylvania, July 2.

The patentee says,—"The nature of my invention consists in providing an inner pipe, to be stationary, inserted into a piece of metal or other material in the lamp, in such a manner as to receive the wick and permit the top of the lamp to be screwed on and off at pleasure, but so arranged that if a person attempted to remove the top whilst the lamp is burning the light or flame would be instantly extinguished."

Claim.—"What I claim as my invention, is the application or addition of an inner pipe or pipes, (one or more as the case may be,) inserted into a piece of metal or other material, as before described, being either stationary or revolving, thereby preventing the top of the lamp from being removed without drawing it over the inner pipe or pipes, and thus extinguishing the flame."

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17. For an *Improvement in Machines for Cutting Felloes;* Joseph and Levi Adams, Hadley, Hampshire county, Massachusetts, July 9.

The patentees say,—"The nature of our invention consists in the combination of certain movements with the shaft of the cutter-head, so arranged that the forward motion of the shaft will cause it to descend while the felloe is being formed by the cutters in the cutter-head, and as soon as that has been accomplished, will automatically throw the shaft upwards into its starting position."

Claim.—"What we claim as our invention, is the causing the shaft E of the cutter-head to automatically descend during its forward motion until the felloe has been formed by the cutters in the cutter-head, and then be thrown upwards to its standing position, substantially in the manner herein set forth: to wit, by resting the said shaft E upon the movable bar, which bar is forced upwards by a spring or weight, and has a rack and a pin connected to its movable end, the said rack being connected with, and caused to descend by the forward movement of, the cutter-head shaft, through the medium of the band, the shaft *f*, and the pinions on the shaft *g*,—which movements are thrown out of gear with the rack at the proper time by the pin and the spring, which act upon the levers and the shaft *g*, substantially as herein described."

18. For *Improvements in Condensers of Steam Engines;* Ethan Baldwin, Philadelphia, Pennsylvania, July 9.

Claim.—"What I claim, is combining with a tubular condenser the receiving and heating reservoir, which is connected at or near its top with the exhaust passage, and with one end of the series of condensing tubes, and at or near its bottom with the other end of the series of tubes, and with the exhausting and feeding pump; the whole constructed substantially in the manner and serving the purposes specified."

19. For an *Improvement in Lath-Cutting Machines;* Charles Graff, assignee of William Bullock, Philadelphia, Pennsylvania, July 9.

Claim.—"What I claim as new, is the arrangement of the lever in combination with the quadrant, rack, pinion, ratchet, screw, and wheel, thereby moving the periphery of the log being cut, an equal distance at each stroke of the knives, (the log being moved by the chuck, instead of applying the power to the periphery of the log,) by which arrangement I can cut laths from square logs, substantially in the manner and for the purposes set forth."

20. For an *Improvement in Quilting Frames;* Charles H. Cook, Coeyman's Hollow, Albany county, New York, July 9.

Claim.—"What I claim as my invention, is the adjustable quilting frame constructed in the manner described, whereby the strained surface of the quilt can be placed in an inclined position, and at any convenient height, thus enabling the quilter to preserve an erect position of the head and chest while at work."

21. For an *Improvement in Apparatus for Cutting Dried Beef;* Gilbert S. Ward and Geo. F. Musselman, assignees of Daniel W. Goble, Newark, New Jersey, July 9.

The patentee says,—"The nature of my invention consists in providing or so arranging a set or series of knives, properly proportioned in size and shape, so as to form any convenient angle for regulating the resistance of the object to be cut in the best manner, to prevent its shearing off to one side when in the act of cutting the same, by adopting such an angle as will produce this desired result; the resistance to the object to be cut is neutralized by the reaction of the compound edges of these sections of the whole knife edge, (they are said to be a series of knives because they are made in three pieces for convenience, while, in reality, they represent one continuous knife,) when the object to be cut is passing in line with the centre between the two side section knives, and so on over the end or middle section knife, placed in the apex of the angle formed by the edges of the two side knives;—while, in the machines with the one oblique blade, the object to be cut is compelled to be kept against said edge by the force of the operator, instead of being regulated by corresponding knives opposite each other, as in my improved mode, which requires only the force of the operator to be principally employed in one direction, which direction is in line with the centre between the edges of the two side knives, and so on over the middle section knife. I also construct the face or bed of the machine so as to allow it to be graduated, to vary the thickness of the shavings to be cut."

Claim.—"What I claim as my invention, is, 1st, the combination of the knives forming an angle to each other, as described.

"2d, I claim the combination of the bed with the other parts, to graduate the thickness of the shavings, as described."

22. For an *Improvement in Spiral Churn Dashers;* Cornelius R. and John Hight, Geneva, Kane county, Illinois, July 9.

The patentees say,—"The nature of our invention consists in the application of a reacting spiral revolving dash, attached to a box churn in a horizontal position. Our dash consists of a shaft and four arms; also two wings made of wood or tin, or any other suitable material. The peculiar construction of the dash consists in setting arms to which the wings are attached at right angles, upon opposite sides of the shaft, so as to produce a quarter twist in the wings as they extend along the shaft from one arm to the other."

Claim.—"What we claim as our invention, is the application of a reacting spiral revolving dash, (the wings of which may be constructed of wood or tin, or any other suitable material,) to a box churn, as described and set forth, or to any of the usual forms of churns to which it may be attached to good advantage."

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23. For an *Improvement in Carts for Spreading Manure;* Joel K. Holland, Beaufort county, North Carolina, July 9.

Claim.—"What I claim, is the combination of the box, bottom, rollers, cylinder, cog wheels, and lever, arranged and operated substantially in the manner described."

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24. For an *Improvement in Lamp Tubes;* Isaiah Jennings, City of New York, July 9.

The patentee says,—"The nature of my invention consists in certain improvements in lamps, said improvements having for their object the regulating of the length of the wick, and adjusting the same without moving it up or down in the tube."

Claim.—"What I claim as of my own invention, is the combination of the two conical tubes, as shown, for forming a regulator for the flame of a lamp, substantially as described."

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25. For *Improvements in Revolving Hammer Fire Arms;* George Leonard, Jr., Shrewsbury, Worcester county, Massachusetts, July 9.

Claim.—"What I claim as my invention, are, 1st, a central hammer to be shifted from some convenient position so as to bear on the central cone, and to be driven by the usual operations of the lock.

"2d, A revolving carriage to carry and turn the hammer.

"3d, A trigger turning on a pivot in the cocking lever, and which is thrown forward into a position convenient to be drawn by pulling said cocking lever. The whole to be substantially as herein described."

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26. For an *Improvement in Sounding Boards for Pianos;* Conrad Meyer, Philadelphia, Pennsylvania, July 9.

The patentee says,—"The nature of my invention consists in supporting the bridge (on which the strings rest) upon a thin auxiliary piece of board, secured over an opening formed in the ordinary sounding board, substantially as represented."

Claim.—"What I claim as my invention, is the supporting the bridge upon a thin base piece secured over an opening formed in the ordinary sounding board, substantially in the manner and for the purpose as herein set forth."

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27. For an *Improvement in Seeding Apparatus of Seed Planters;* Samuel and Morton Pennock, Kennet Square, Chester county, Pennsylvania, July 9.

The patentees say,—"The improvements which we now desire to have patented relate to a new construction and arrangement of curved arms, forming part of the tubular drill tooth, or depositing tube, embracing the drag-bar, for diminishing or increasing the angle of the same with the drag-bar, to cause it to open a deeper or a shallower furrow,—to break the wooden holding pin and turn on the joint bolt when the tooth strikes against a stone or a stump, or other impediment, and thus save the depositing tube;—and likewise to turn in an opposite direction, without breaking the wooden pin, whilst backing the machine when the depositing tube is in the ground; and also to hook upon the axletree for suspending the depositing tube from the ground, to prevent it from being injured whilst moving the machine from the farm yard to the place where it is to be used upon its own wheels. Said curved arms serving also the purpose of braces to stay the depositing tube from any lateral movement during its operation, or when the machine is run backwark or turned short or suddenly whilst the tube is in the ground.

"Likewise in the employment of spring bearing plates for the boxes of the gudgeons of the seed roller, to confine it in its proper place, and yet be allowed to yield when the surface of the roller is uneven or swollen from any cause, and for adjusting the roller to the grate."

Claim.—"What we claim as new, is constructing the tubular drill tooth with a hook-shaped arm, in the manner and for the purpose herein set forth, by which the drill tooth is braced laterally whilst in operation, and hooked to the axle when not in operation, and by which the angle of the drill tooth may be changed at pleasure, by changing the position of the wooden pin in said arms, and by which the drill tooth may be folded towards the drag-bar in backing the machine, or turning short round, whilst the drill tooth is in the ground, without breaking the wooden pin, said wooden pin resting upon the top of the drag-bar instead of passing through it, as herein fully set forth.

"We also claim the spiral or any other form of spring, in such combination with the hopper, grate, and seeding cylinder, or the distributing apparatus, as will make the said cylinder, and grate, and hopper, self-adjustant, each to each and to the others, in case there should be a want of evenness or uniformity upon the surface of the seeding cylinder or distributing apparatus, for the purpose and in the manner above set forth."

28. For *Improvements in Chargers Attached to Fire Arms;* Orville B. Percival, East Haddam, Middlesex county, Connecticut, and Asa Smith, City of New York, July 9.

The patentees say,—"The nature of our invention consists in the modes of constructing and using a magazine containing powder, balls, and percussion seed, and attached to the breech of the gun, and made to turn over chambers in the breech of the gun, and drop balls, powder, and percussion seed, through perforations in the barrel of the gun, near the breech, and to be turned back half-way round under the breech, tô cut off all communication and prevent explosions in the magazine when the charge in the gun is fired."

Claim.—"What we claim is the revolving ball magazine, as above specified, in connexion with the revolving cylinder."

29. For an *Improvement in Machinery for Measuring Pulp in the Manufacture of Paper;* Henry Pohl, Paterson, New Jersey, July 9.

The patentee says,—"The nature of my invention consists in providing a movable lid in the regulator cylinder, the said lid being operated by a screw, to set the lid in the cylinder at any point desired, to regulate the quantity of pulp to be admitted, to make sheets of paper of any thickness.

"The nature of my invention further consists in providing the movable lid with an orifice in it, communicating with the pulp chamber of the cylinder, and with the atmosphere by a tube, at the bottom of which tube there is a small cylindrical air chamber, with a ball fitting to move up and down to act as a valve, to allow the air to pass out by the tube when the pulp is forced into the cylinder, and to close the tube when the air is all forced out; then to allow the air to rush in when the discharge gate is open, to assist in forcing out the pulp, and to do this with the utmost regularity."

Claim.—"I claim, in combination with the measuring vessel herein described, the adjustable lid, constructed with an opening in it communicating with the pulp chamber in the cylinder, and with the atmosphere through the small cylindrical chamber and the pipe, the communication being closed and opened by the ball, in the manner substantially as described, for the purposes set forth."

30. For an *Improvement in the Boilers and Gearing of Locomotive Engines for Working Heavy Grades;* George E. Sellers, Cincinnati, Ohio, July 9.

The patentee says,—"My improvements are especially applied to locomotives for running on heavy grades, but are also applicable to running on level roads. The first part of my invention relates to an improvement in locomotive steam engines, secured to me by letters patent bearing date the 13th day of November, 1847, in which horizontal auxiliary driving wheels are used to gripe the central rail for overcoming heavy grades, the gripe of the said auxiliary wheels being effected by the draught of the train, and, when desired, aided by what I term a steam spring.

"In my original invention the auxiliary driving wheels, which are necessarily horizontal, are, from the nature of the general arrangement, placed at the back of the locomotive, and receive their motion from auxiliary engines through the intervention of cranks and bevel gear wheels.

"My present invention consists in communicating motion from the auxiliary engines to to the crank on the shafts of the auxiliary driving wheels by direct connexions, such as connecting rods, when this is combined with a separate shaft on which are placed the eccentrics for operating the valve gear of the auxiliary engines, which shaft has cranks at right angles, each connected with one of the auxiliary engines by a connecting rod to a cross head, at another part of the piston rod from that at which the connecting rods of the auxiliary driving wheels are attached. By these means the alternate action of the two engines on the auxiliary drivers is insured, and I am enabled to place these drivers in the middle of the locomotive, and to increase the length of the boiler, on an engine in the same length in the frame, and also to place the auxiliary cylinders below the boiler.

"The second part of my invention relates to the boiler, mainly with the view to adapt it to the inclination of heavy grades; and also to the obtaining of a better circulation of the water, and a more perfect combustion, with a view to economize fuel."

Claim.—"What I claim as my invention, is the method substantially as herein described, of operating the two horizontal auxiliary driving wheels of locomotive steam engines by connexions with the auxiliary engines, when this is combined with the connexion of the piston rods of the two auxiliary engines with a crank shaft having the cranks thereon at right angles, substantially as described, whereby the engines are made to alternate in their action as specified.

"I also claim the method substantially as described, of establishing a connexion between the dome and the forward end of the boiler, when this is combined with the extending of the flue tubes to the top of the boiler, as described, whereby the boiler is adapted to heavy grades, as described.

"I also claim, in combination with the water-ways surrounding the fire chamber, the water channel at the bottom of the boiler, as described, whereby a circulation of the water is established between the two ends of the boiler."

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31. For an *Improvement in Machines for Cutting Screws;* Thomas J. Sloan, City of New York, July 9.

The patentee says,—"The principle or character which distinguishes my invention from all other things before known, consists in determining the pitch of the threads by means of a leader which turns in the arms of a rocking shaft, operated by a cam so formed as, at the end of each threading motion, to disengage the threads of the leader from the teeth of a comb on a bar which operates or carries the tool-holder, and to re-engage them at the end of each return motion, when this is combined with a relief cam, which, at the end of each threading motion, acts upon the comb bar and pushes it forwards with greater velocity, to relieve the leader preparatory to its being disengaged from the comb, and then to ease the said bar in its back or return motion."

Claim.—"What I claim, therefore, as my invention, is the method substantially as herein described, of determining the pitch of the threads of wood screws by means of a leader, the threads of which are alternately engaged and disengaged from the teeth of a comb on a sliding bar, when this is combined with a relief and return cam, which, at the end of each threading motion, pushes the comb forward to relieve the leader before it is disengaged from the teeth of the comb, and then eases off the return motion of the comb bar, substantially as described."

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32. For an *Improvement in Store Counters;* Evan O. Thomas, Philadelphia, Pennsylvania, July 9.

The patentee says,—"The nature of my invention consists in making counters in sections of suitable lengths for removing when filled with goods; each section to be provided with a loose top, ends, and side, so that it has the appearance of being double when the top is not elevated. Inside of the above top and case will be constructed a chest, fitted loose enough for the casing and top to be elevated with ease when forced by the action of the axle and crank; the chest to be placed on two axletrees and four wheels, of suitable dimensions for removing the counter with ease without occupying too much room. The chest will be constructed with a double bottom, in the centre of which will be placed an axle with a tooth wheel to fit between the bottoms, allowing room for a catch.

"The ends of four cords, straps of leather, gutta percha, or chains of metal, will be permanently fixed to the axle, and running under the upper bottom on friction rollers, and ascending near the top of the ends of the chest, where they pass over friction rollers and descend between the chest and casing, where it will be fastened to the casing near the bottom."

Claim.—"What I claim as my invention, is the construction of a store counter, made in two parts in the manner described, for the purpose of varying the capacity within, and at the same time to give better security in case of burglary, and aid transportation in case of fires, as herein set forth."

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33. For an *Improvement in Joints for Compasses for Measuring;* Theodore Alteneder, Philadelphia, Pennsylvania, July 16.

Claim.—"What I claim as new, is a compass joint formed of two surfaces held together by centre screws passing through a cap piece, substantially as described."

34. For *Improved Machinery for Double Folding Wide Cloth;* Zachariah Allen, Providence, Rhode Island, July 16.

Claim.—"What I claim as my invention, is the use and application of the rigid prong or extension piece, to act upon the middle of the piece of cloth in the process of folding it, in connexion with the winding rollers, to secure the exact double folding of the cloth, as above described."

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35. For an *Improvement in Self-Weighing Machines for Grain, &c.;* W. W. W. H. T. Bramble, Lafayette, Tippecanoe county, Indiana, July 16.

The patentee says,—"The object of my invention is to furnish an apparatus that may be set to weigh or measure any number of bushels of grain without further attention or care than to set the apparatus, and set the grain to running into it from the loft in which it is contained; the rest of the work is then done by the machine, and registered on an index plate attached thereto."

Claim.—"What I claim therein as new, is the combination of a steelyard with a weighing box having several compartments which receive the grain alternately, and when a certain quantity has been received, the full compartment is discharged, being disengaged by the depressed position of the steelyard, and at the same time another compartment is presented for filling; the apparatus being operated by the weight of the grain itself, so as to form an automatic weighing machine, by which, with the aid of a register or index, the amount weighed is ascertained, substantially as above set forth."

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36. For an *Improvement in Horse Powers;* James L. Cathcart, Washington City, D. C., July 16.

The patentee says,—"My invention consists in improvements in horse powers for general agricultural uses, which combine the qualities of strength, portability, lightness, and durability in an eminent degree, as well as great facility for setting up and taking to pieces for transportation from place to place; and also an arrangement by which the horses can be taken in and out, and the arms and rim, while at work, be at that height from the ground which is the best for the attachment of the traces in the proper line of draught."

Claim.—"What I claim is the eccentric pivot, which, by turning round, allows the entire wheel to be withdrawn from the pinion, and when raised by the lever, the wheel can be tilted up for the purpose of taking the horses in or out, substantially as set forth."

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37. For an *Improvement in Hill-Side Ploughs;* William L. Chase, Boston, Massachusetts, assignee of Mark L. Chase, Frankfort, Waldo county, Maine, July 16.

Claim.—"What I claim is the combination of the adjustment of the hooked bar with those of the main brace, whereby the pitch of the mould-board may not only be increased or diminished, but the proper support of the upper part of the plough-share be maintained under any angle of pitch, all as specified. The same also admits of a change of the mould-board, viz: the substitution of one larger or smaller.

"I also claim the above described peculiar construction of the sward cutter, with its groove to receive the sharp edge of the land-side, in combination with the notch in the land-side of the share for receiving its lower end, and the notch or shoulder in the upper part of the sheath for receiving its upper end, substantially as specified."

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38. For *Improvements in Steam Boilers;* F. P. Dimpfel, Philadelphia, Pennsylvania, July 16.

Claim.—"What I claim as my invention, is, 1st, arranging a series of bent water tubes within the flue space of a boiler, and connected at each end with the body of water in the boiler, substantially as described, by means of which the circulation of water is greatly increased, and the injurious effects due to expansion and contraction avoided, substantially as described.

"2d, I also claim surrounding the crown-sheet, to which the ends of circulating tubes or their equivalents are attached, with a rim, substantially as and for the purpose specified.

"3d, I also claim extending the ends of the tubes, or the equivalents thereof, above the crown-plate or roof of the fire-box, or any other plate or plates one side of which is fire surface, to which they are attached, when the other or lower end communicates with a water space or spaces below or beyond the plate to which the upper ends are attached, substantially as and for the purpose specified.

"4th and lastly, I claim giving a forced circulation to the water through the boiler or generator by mechanical means, substantially as and for the purpose specified."

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39. For an *Improvement in Spring Saddles;* George Fisher, Raleigh, Wake county, North Carolina, July 16.

The patentee says,—"The nature of my invention consists in making the seat part of the saddle movable, and applying springs beneath it for the purpose of affording ease in riding. These springs may be of any suitable strength to suit the weight of the rider, and each saddle may be provided with two or more sets of springs of various forms and strength."

Claim.—"I claim the springs represented, or springs of any other form producing the same effect, placed between the movable seat and the body of the saddle, in such a manner as to be easily taken out and changed as described."

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40. For an *Improvement in Spike Machines;* Moore Hardaway, Troy, New York, July 16.

The patentee says,—"The nature of my invention consists in a new and useful combination and arrangement of mechanical devices, and mode of operating the same, by which the spike is cut from the heated rod, griped and held firmly between horizontal dies, bent down at one end, and hook-headed and rolled out longitudinally at the other end, and pointed between an inclined stationary and a rolling die; the several operations being performed almost simultaneously and at every revolution of a cam shaft, operated by steam or other power, by which hook spikes of a superior character are produced."

Claim.—"What I claim as my invention, is the method of imparting to the header a compound motion for first bending the end of the spike downward, and then moving it forward against the die to form the hook end, simultaneously with the operation of rolling the opposite end to the form of a wedge, with a roller of the same width of periphery as the thickness of the spike; the said header being fixed to the end of a turning shaft, passed through the lever, and inserted into a segmental cogged or toothed plate, made to match into a fixed segment rack, by which the angle of the header is changed to correspond with the required form of the head of the spike, as the lever is vibrated by the motion of the cam shaft, and the roller being moved in the arc of a circle as it rotates on its own axis, by being attached to the short arm of the bent lever, whose long arm is attached to a wrist of the wheel or plate on the cam shaft, as herein fully set forth."

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41. For *Improvements in Knitting Machines;* Joseph Holden, White township, Cambria county, Pennsylvania, July 16.

Claim.—"What I claim as my invention, is, 1st, the projecting and withdrawing the needles separately and singly, with their arrangement as described, by which I am enabled to knit closer work with stouter needles, substantially as described.

"2d, In combination therewith, I claim the combination of the jack, the sinkers, and depressers, substantially as described.

"3d, I claim the thread bearer, having an extended sideway motion to and fro at each stitch, by which it lays the thread across the needle at each stitch, and returns with it to be ready for the next stitch.

"4th, I claim the spring vice for regulating the supply of thread to the needle opened by the rod, substantially as described.

"5th, I claim the particular arrangement and combination of the several parts of the machine, by which their various motions are derived from a single crank and screw thread, substantially as described."

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42. For an *Improvement in Surveyors' Compasses;* John Locke, Cincinnati, Ohio, July 16.

Claim.—"What I claim as my invention, is the application of the partial lens, or lens of reduced size, by means of which to view a cross-wire or a sight mark in optical contact with the object aimed at, either in the compass, in gunnery, or for any other purpose requiring and using a sight in the manner herein described, or any other substantially the same, and which will produce the intended effect; especially do I claim also the arrangement by which my compass sight is made susceptible of having either end used as the eye-piece, and by which back and forward sights can be taken without disturbing the instrument.

"I also claim the convenient model of the compass to be used with the sight here described, viz: with a super-imposed plate, and with the sight planted and supported upon it, and with the opposite readings at such places as are required in order to obtain indirectly the reading of the occasionally concealed end of the needle."

43. For an *Improvement in Sizing Compounds for Warps or Yarns;* William Mallerd, Providence, Rhode Island, July 16.

Claim.—"I lay no claim to a combination of starchy matters and resinated alkalies alone, but my invention and what I claim consists, 1st, in the combination of the same and the composition of animal tallow, oil, and caoutchouc, in, or about in, the proportions specified, and for the purpose described.

"I also claim the combination of alcohol with the composition of resinous, alkaline, and other matters, as specified and for the purpose as stated."

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44. For an *Improvement in Machines for Cutting Veneers, &c.;* Conrad Poppenhusen, City of New York, July 16.

The patentee says,—"The principle of my invention consists in the application of a sliding carriage with knife, the latter fastened in such manner as not to break the veneer or board, and to cut the exact thickness; and the application of a spring, so as to cut the wood clearly off and throw the veneer out."

Claim.—"What I claim as my invention, is the application to machines for cutting veneers and thin boards, of a sliding carriage (or gate) with knife and spring, substantially in manner and for the purpose herein described."

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45. For an *Improvement in the Seeding Apparatus of Seed Planters;* George Rohr, Charlestown, Jefferson county, Virginia, July 16.

Claim.—"What I claim as my invention, is, 1st, the combination and arrangement of the segmental plates or valves, secured together by circular rings or heads, and arranged over the circumference of the cylinder, adjacent to the openings therein, with the rotating cylinder constructed as described, for the purpose of partially or entirely closing the openings in the cylinder through which the seed passes to the depositing tubes, and thus regulate or check the discharge of the seed as described.

"2d, The arrangement and combination of the elliptical spring, rising and falling beam, pivoted beam, and hand lever, with the depositing tubes and drill teeth, by which all the depositing tubes and drill teeth may be raised and lowered simultaneously as described, without stopping the planting.

"3d, The arrangement of segmental shields or covers on either side of the upper portion of the rotating cylinder, in combination with the intermediate semi-circular spouts or gutters beneath the cylinder, by which any waste of seed is prevented during the rotation of the cylinder, or its discharge from the openings before passing the segmental shields or covers, as described."

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46. For an *Improvement in Feeding Apparatus of Straw Cutters;* David Stiles, Jr., Middleton, Essex county, Massachusetts, July 16.

Claim.—"What I claim as new, is attaching the feed hand to the reciprocating knife-gate *below* the bottom of the feed trough, when said bottom is made with an opening next the knife, in which the feed hand operates, and through which all extraneous and hard substances descend before reaching the knife, so that whilst the said feed hand acts on the hay or straw, or whatever is to be cut, at its most compact part, it at the same time offers no obstruction to the insertion of the straw, as it stands entirely out of the way and leaves the top open and free, the opening in the bottom of the trough serving to rid the hay or straw, or cornstalks, of sticks, stones, and other objectionable substances which would tend to injure the knives."

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47. For an *Improved Apparatus for Regulating the Contraction of Car Wheels;* Samuel Truscott, Columbia, Lancaster county, Pennsylvania, July 16.

The patentee says,—"The nature of my invention consists in the gradual cooling of the hub of cast iron, by directing centripetal streams of cold air or water against the surface of the hubs of wheels cast in a chill."

Claim.—"What I claim as my invention, is the combination of the apparatus for directing the cooling fluid centripetally against the outside surface of the hub, when constructed in the manner herein set forth, with the apparatus for letting the sand descend from around the hub, and retaining it over and about the arms and rim, as described.

"I likewise claim the combination of the bed-plate, made with the curved conductor and slide to confine and discharge the sand, with the circular iron ring which forms and chills the tread of the wheel."

48. For an *Improved Steering Apparatus;* Charles F. Brown, Warren, Bristol county, Rhode Island, July 22.

The patentee says,—"The nature of my invention consists in operating the rudder by means of a steering wheel placed in a horizontal position directly above it, the wheel being firmly secured on the head of a screwed shaft or spindle, which has a bearing in the crown of a hollow metal pillar encasing the head of the rudder post, and secured to the deck or stage on which the steersman stands, and is prevented from moving up or down; the head of the rudder post is of metal, and has a metal cap provided with any convenient number of helical grooves, and on this metal cap a hollow metal socket is placed, having helical feathers or threads fitting to the grooves on the cap of the rudder post; the socket has also straight feathers fitting in grooves inside the pillar, and in its crown or head is a female screw, in which the screwed spindle carrying the wheel fits; the wheel being turned in either direction will cause the screw to elevate or depress the socket, and the helical threads or feathers in the socket acting upon the grooves in the head of the rudder post, will cause the rudder to turn in the same direction as the wheel."

Claim.—"What I claim as new, is operating or turning the rudder by means of the socket, so guided that it can be moved only in the direction of its length, and having helical threads or grooves fitting to corresponding grooves or threads on the head of the rudder post, and being moved in either direction in the line of the axis of the rudder post by means of a screw, attached to, and operated by, the steering wheel, substantially in the manner herein described."

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49. For an *Improvement in Truss Pads;* Frederick M. Butler, City of New York, July 22.

The patentee says,—"My invention consists, 1st, in the exact shape in which the case should be formed to adapt itself to the boundaries of the thigh and pubis, that being generally a rounded obtuse angle.

"2d, The proper quilling or curling of the outer and under edge thereof, adapted to the rotundity of the abdomen.

"3d, The exact and proper method of padding the same so as to suit the configuration to which it is adapted, and thus avoid making too great pressure upon the fullness of the abdomen, by bearing firmly with the raised parts of the pad which pass outward of, and underneath, the muscles of the abdomen and form a plano-concave pad."

Claim.—"What I claim as my invention, is the formation of the pads for trusses, braces, supporters, &c., as above described, to wit: made of shape in the boundary seen in the figures, (a rounded obtuse angle,) and the padding made somewhat hollow and fullest on the sides A A A A, adapted to bear under and outwards of the fullness of the abdomen, making a plano-concave pad, whether single or double."

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50. For an *Improvement in Fastening the Shoes of Hill-Side Ploughs;* William L. Chase, Boston, Massachusetts, July 22.

The patentee says,—"My invention consists, 1st, of a shoe or runner, so fitted to the lower edge of the land-side that it can readily be removed therefrom to be replaced by another, when worn, broken, or for any other cause it is required to remove it, this removable shoe being fitted with either sockets or pivots at its ends, to which the mould-board is connected, and on which it turns.

"The second part of my invention consists in making the land-side with two faces, but otherwise shaped and proportioned like the land-side of the ordinary plough for working level land, that turns the furrow in one direction only."

Claim.—"What I claim as new, is the device for attaching and detaching the removable shoe, having the mould-board hinged to it, and being fastened to the land-side, substantially as herein set forth."

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51. For *Improvements in the Method of Making Wrought Iron directly from the Ore;* Alex. Dickerson, Newark, New Jersey, July 22.

The patentee says,—"1st, The distinguishing features of my improvements are in substance as follows: The construction and arrangement, substantially as herein described, of a deoxidizing furnace, consisting of a crucible formed by the union at bottom of two concentric, or nearly concentric, cylinders, or other shaped vessels, having free circulation of the hot gases within and around them, so as to appropriate the heat of the gases from the puddling furnace freely and equally to all parts, while at the same time no portion of the heating gases, or of the atmosphere, is permitted to mingle with the ore, except what little of the former may enter during the deposition of a charge or batch; the above being so combined and disposed in connexion with a puddling furnace, as that the deoxidized ore may be deposited on the puddling floor, and be converted into balls without having been exposed to the neutralizing contact of the atmosphere at any period of the process, or of its reduction from the ore into balls.

"2d, Such a form and disposition of the crucible as to insure an even and thorough distribution of the heat, and thereby to avoid the extremes both of excessive and of insufficient heat."

Claim.—"What I claim as my own invention in the above process for making wrought iron direct from the ore, is deoxidizing the ore in a chamber which is so constructed and arranged as to be heated by the waste heat, and at the same time prevent the product of combustion coming directly in contact with the ore, except during the time of charging, and likewise permits the charge of deoxidized ore to descend upon the puddling floor or working bottom without exposure to the atmospheric air; the whole substantially in the manner, and by the use of apparatus, substantially such as herein described."

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52. For an *Improvement in Machines for Raking and Binding Grain;* John E. Heath, Warren, Trumbull county, Ohio, July 22.

Claim.—"What I claim as new is, 1st, gathering the grain and compressing it into a sheaf, substantially as herein set forth, by means of the rake and standards.

"2d, Carrying the cord round the sheaf and holding the latter until the band is tied by means of the curved lever and toothed arms, substantially as described.

"3d, The employment of the split thimble and sliding hook, to aid in tieing the band.

"4th, Alternating the rake to gather the grain and compress the sheaf, by means of the spring, strap, and drum, substantially as herein set forth.

"5th, Bridging the space through which the bound sheaf drops, to support the grain while it is being gathered, substantially as set forth."

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53. For an *Improvement in the Application of Electro-Chemical Printing in Colors for taking Ayes and Nays;* Albert N. Henderson, Buffalo, New York, July 22.

The patentee says,—"My invention consists of an apparatus by which words, signs, letters, &c., can be permanently printed on paper or other fibrous substance, by a person or persons situated at a distance, by means of the galvanic current."

Claim.—"What I claim as new, is, 1st, the mode substantially as described, of imprinting words, letters, figures, &c., upon paper or other fibrous substances, by placing the paper or other substance, either chemically prepared or not, as above set forth, between two surfaces of a metal which is not acted on by the substances employed, on one of which the letters or figures are raised, by passing a current of galvanic electricity through the prepared material, substantially as above described.

"2d, I claim passing the electric current between metallic surfaces, as above described, through damp paper otherwise unprepared, and afterwards applying a chemical solution by which the effect of the electricity becomes visible whenever it has passed through the paper, for the purpose above described, telegraphing, &c."

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54. For an *Improvement in Directing Water upon Water Wheels;* Marcius B. Ashley, Watertown, Jefferson county, New York, July 30.

The patentee says,—The nature of my invention consists of three parts: 1st, The providing of a tramming or plumbing collar or box in the interior of the bed or lower stone, whereby the shaft can be plumbed at any time by the miller far more conveniently than by any plan heretofore used.

"2d, The construction and mode of operating the water gates.

"3d, The collar or boot of the shaft, to make it run always on a centre, and to be easily repaired, &c."

Claim.—"I claim the adjustable vertical water mouths or openings, arranged in combination with the outer or longest edge of the buckets, as described, whereby the greatest effect is obtained."

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55. For an *Improvement in Machinery for Turning Out Wooden Bowls;* Addison Everett, Middlefield, Hampshire county, Massachusetts, July 30.

The patentee says,—"The nature of my invention consists in turning wooden bowls from blocks of wood by means of gouges, cutters, and spurs, fixed in strong movable frames, which are adjusted in such a manner as to insure a rapid and economical manufacture of bowls of any thickness or shape required; and in the simplicity of the cutters and spurs, which are easily made and sharpened."

Claim.—"What I claim as my invention, is the combination of the movable frames with the reciprocating frame carrying the curved cutter arm, connected and operating as described. Also the combination of the curved cutter arms with the reciprocating frame for the purpose described. And also the cutters, the spurs, and the guards, constructed as described, and connected and fastened to the curved cutter arms, in the manner and for the purpose substantially as herein described."

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56. For an *Improvement in Stanchions for Cattle;* George W. Hatch, Parkman, Geauga county, Ohio, July 30.

Claim.—"What I claim as my improvement, is the arranging of the stanchions in a vibrating frame, to accommodate the position of the animal when lying down

"I also claim the stanchion or fall piece *g*, in connexion with the stay cords, by which means it is brought to an upright position when closing the stanchion *h*, thereby preventing an animal taking the place which is occupied by the stanchion *h* when open.

"I further claim the catch and spring to hold the stanchions in an upright position, in combination with the rope for releasing the cattle from confinement, as specified."

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57. For an *Improvement in the Attachment of Prison Locks;* Edward Kershaw, Boston, Massachusetts, July 30.

Claim.—"What I claim as my invention, is the combination of the stud and its recess or hole, or their equivalents, with the cell door opening and the double hinged arm and lock, substantially in the manner and for the purpose of preventing strain on the lock by pressure against the cell door, by a prisoner or person within the cell, as above specified."

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58. For an *Improvement in Attaching Hooks and Eyes to Paper Cards;* Peter Kirkham, Waterbury, New Haven county, Connecticut, July 30.

Claim.—"What I claim as my invention, is the indenting or impressing the cards or sheets of paper in such a manner as to retain the hooks and eyes in their proper places upon the card until they can be fastened, in whatever manner they may be finally secured."

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59. For an *Improvement in Churn Dashers;* Joseph Marsh, Petersburg, Menard county, Illinois, July 30.

The patentee says,—"The nature of my invention consists in two convex pieces of tin or other suitable material, perforated and placed on the upright, which, when put in motion, creates a suction of atmosphere through the milk."

Claim.—"What I claim as my invention, is the double concave, perforated, discoid churn dasher, as herein described, and for the purposes set forth."

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60. For an *Improvement in Distilling Spirits of Turpentine;* Charles J. Meinicke, City of New York, July 30.

Claim.—"What I claim as my invention, is the process as described for distilling turpentine, so that the spirits of turpentine are distilled and the rosin saponified, ready for soap making, at one operation."

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61. For *Improved Valve Gear for Steam Engines;* George B. Milner, Houston, Harris county, Texas, July 30.

The patentee says,—"The nature of this invention consists in attaching the end of the connecting rod, which operates the valves for admitting steam to the cylinder, to the centre of a transverse traversing bar or lever, attached by bolts at its extremities to parallel sliding rods, one of which operates the escape valves, and both being provided with square frames at their ends, surrounding D-shaped cams or eccentrics secured on the main shaft, one of which is made movable and provided with a segmental slot through which is passed a bolt, so as to enable said cam or eccentric to be secured in such relation to the other cam or eccentric as to cut the steam off when the piston has reached any desired point in its stroke, and to cause the steam admitted to the cylinder to expand and exert its force on the piston the remainder of the stroke."

Claim.—"What I claim as new, is the combination of the fixed cam, with its frame and rods, and the adjustable cam, with its frame and rods, to which latter are attached the traversing and oscillating bar, having secured to one end of it the rod *g*, and at or near its centre the rod H, which actuate respectively the eduction and induction valves, substantially in the manner herein described, forming together a simple valve motion, and one which enables the engineer to regulate the degree of cut off at will."

62. For an *Improvement in Rubbing and Polishing Stone;* Adrian Olcott, Millstone, Somerset county, New Jersey, July 30.

The patentee says,—"The nature of my invention consists in a new arrangement and method of securing and holding blocks of stone upon a rubbing bed, for the purpose of facing them, the blocks being placed and held in such manner that they are continually moved about on the bed over the whole surface, wearing it equally in all parts, so that it remains perfectly level, and produces a corresponding flat and true surface to the stone."

Claim.—"What I claim as my invention, is attaching the stone to be faced to a chain, one end of which is attached to a windlass, by which it may be lengthened or shortened, the stone being left free, so as to be continually changing its position on the bed during the operation of rubbing, by which an uniform and even wear is produced on the bed, and a true face given to the stone, in the manner substantially as described."

63. For an *Improvement in Atmospheric Churns;* John O'Neil, Xenia, Greene county, Ohio, July 30.

Claim.—"What I claim as my invention, is the construction of the air tube in combination with the plungers and partition, as set forth, whereby the cream is thoroughly agitated and intimately mixed with atmospheric air, by forcing it alternately to the opposite sides of the partition through branches of the air tube, as set forth."

64. For a *Jigger Windlass;* Charles Perley, City of New York, July 30.

Claim.—"I claim as new, 1st, the application of the double acting pawls, ratchet, disk, socket, and handspike, with or without the winch-head, whereby the power is applied to the horns to rotate them in either direction, as required; said application and arrangement being a combination of the double acting winch, described in my patent of 29th May, 1849, and the cable-lifting horns described in my patent of 21st March, 1848, heretofore referred to, whereby this combination of these two previously patented inventions effects new and useful purposes, not contemplated and not attainable by either of the inventions separately, substantially as described."

65. For *Improvements in Apparatus for Sizing and Drying Cotton Batting;* Elias P. Rider, City of New York, July 30.

Claim.—"What I claim as my invention, is, 1st, doubling and turning the ragged and uneven edges of the bat of cotton as it comes from the carding engine, and pressing them down to form a smooth selvage, as set forth, by means of the curved plates in combination with the cylinders, as described, or other equivalents.

"2d, I claim heating and ironing the surface of the bat of cotton previous to being glazed, for the purpose set forth, whether performed by the means herein described or other equivalent means.

"I likewise claim making the floating cylinder with check rings or their equivalents, in the manner and for the purpose described.

"I claim passing the bat through a space between the floating cylinder and compressive cylinder, and imparting the sizing to the bat of cotton without pressure, as described.

"I claim making the drying chamber a double inclined plane, in combination with the chimney constructed as aforesaid, for the purpose of increasing the circulation.

"I also claim the peculiar combination of the heating, selvaging, ironing, and glazing, and drying apparatus, by which the bat of cotton, as it comes from the carding engine, is selvaged, ironed, glazed, and steam-dried by a continuous process, as herein fully set forth, the sizing vat being placed directly beneath the compressive cylinder, so that the sizing can be introduced fresh from the vat to the bat as it comes from the ironing cylinder, as described."

66. For an *Improvement in Purifying Coal Gas;* Joseph A. Sabbaton, Albany, New York, July 30.

The patentee says,—"My improvement consists in that, instead of using lime alone, I use a mixture of lime and coke dust, (technically called 'breeze,' an article now thrown away as useless,) or in its stead charcoal dust or any other substance of that nature, the object being thereby to produce a separation of the particles of lime, by which means a greater number of them are exposed to the action of the gas; and besides this mechanical action, the carbonaceous matter exerts a chemical action on the ammonia and other impurities contained in the gas, and separates them from it."

Claim.—"What I claim as my invention, is the mixture with coke dust or 'breeze,' charcoal dust, or other carbonaceous substance, for the purposes of acting mechanically in the separation of the particles of lime, and at the same time acting chemically in removing various impurities from the gas, which cannot be separated by the ordinary methods of purifying gas, substantially as above set forth."

67. For an *Improvement in Connecting Hubs with Axles;* Eliphalet S. Scripture, Green Point, Kings county, New York, July 30.

Claim.—"What I claim as new, is the application of the half-boxes with the semi-circular lip and rib, constructed to enter the grooves near the end of the axle box, said boxes being secured together and connected to the axle bar by any competent means, and said ribs, grooves, and boxes operating as a substitue for a collar on the axle, and to hold the axle box and wheel on the axle, and also to keep dust out of the parts, substantially as described."

68. For an *Improvement in the Arrangement of Pressure and Feed Rollers in Planing Machines;* Charles A. Spring and Peter Boon, Kensington, Philadelphia county, Pennsylvania, July 30.

The patentees say,—"The nature of our invention consists in placing a cylinder of knives, constructed on any of the most approved plans, in an oblique position, say at an angle of 45°, more or less, with the line of motion of the board through the machine.

"We also construct the bed of the machine so that it may be moved to or from the knife, which allows it to be set to plane boards of any thickness, or to move it back from the planing cylinder if required."

Claim.—"What we claim as new, is connecting the movable weighted pressure rollers with the stationary ones by oblique links, in combination with the additional rollers, the whole arranged substantially in the manner and for the purposes set forth."

69. For *Improvements in Machines for Forming Tubes of Sheet Metal;* Joseph Stout and James T. Stanton, Waynesville, Warren county, Ohio, July 30.

The patentees say,—"The nature of our invention relates to such arrangements of machinery heretofore in use, as have a roller around which a metallic candle mould or other tube is formed, which can be easily detached from the machine in which it works, so as to admit the tube formed on it to be slipped off at one end, instead of having to be sprung open and thrown out of a round form. And also having spring bearings for the rollers, thus enabling them to adjust themselves to the thickness of the material used in them."

Claim.—"What we claim as our invention, is supporting the forming roller upon the short ends of the bent levers, in combination with the upper roller supported by springs, substantially in the manner and for the purposes herein described."

70. For an *Improved Bolt and Rivet Machine;* William E. Ward, Port Chester, Westchester county, New York, July 30.

The patentee says,—"The nature of the first part of my invention consists in gauging the length of the shank to be cut off after the head has been formed, by feeding in a rod against a rest beyond the blades, which has a lateral movement to permit the head to pass by it, and, by the operation of cutting off the shank, determining or gauging the length of wire which shall project beyond the dies to form the next head.

"And the last part of my invention consists in cutting off the length of the shank by the return lateral motion of the header, in combination with the movable rest."

Claim.—"What I claim as my invention, is, 1st, gauging the length of the shank after a head has been formed on the end, by pushing the head against a gauge beyond the header, which has a lateral motion to allow it to pass by, substantially as described, in combination with the operation of cutting off the shank at such distance from the griping dies as, by the same operation to determine or gauge the length of rod or wire which shall be left projecting beyond the griping dies for forming the next head, substantially as described.

"And lastly, Cutting off the rod or wire, after the head has been formed, by the return lateral motion of the header, in combination with the rest, substantially as described, the edges of the rest and heading die being formed to answer the purpose of shears, as herein described."

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71. For an *Improvement in Car Seat Backs;* Thomas E. Warren, Troy, New York, July 30.

The patentee says,—"The nature of my invention consists in forming the back of spring sheet iron, or any other suitable metal, the same extending along two or more seats on the same base; the back is in a curved form for each seat; by this mode they are rendered cheap of construction, and give ease to the sitter in consequence of the form given to them to constitute the spring."

Claim.—"What I claim as my invention, is the forming of the backs of car seats of double curved plates of metal attached by the ends to the arms of the seat, made to embrace both sides of the end pieces to which they are pivoted, and on which the car seats are reversed, formed, stayed, and braced substantially in the manner and for the purpose herein specified."

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72. For an *Improvement in the Countertwist Speeder;* Jesse Whitehead, Manchester, Chesterfield county, Virginia, July 30.

The patentee says,—"My improvement relates especially to serrating the sides of the groove in the revolving shaft, so that the roving may be drawn from the twisting band by said shaft instead of having to rely upon the draft of the bobbin, in combination with the effect produced by the increased diameter of the portions of the shaft from which the bobbin receives its motion, thereby winding the roving upon the bobbin without producing an undue draft on the roving between the shaft and the twisting band, the serrated groove holding the roving and preventing it from slipping whilst the requisit draft is imparted to it in the space between the groove and the bobbin, which will cause the roving to be wound upon the bobbin in a compact state, and diminishing the danger of breaking.

"Also in the employment of a certain pendant arm and spring, the former attached to one of the arms that hold the bobbin, and the latter to the carriage, for the purpose of preventing the dancing or rapid vibration of the bobbin upon the shaft as the bobbin fills, by which the roving is made uneven and frequently broken."

Claim.—"What I claim as new, is making the shaft with a serrated groove, in combination with the reduced portions of the shaft adjacent to said groove, wherein the roving runs from the twisting band to the bobbin, in the manner and for the purpose set forth.

"I also claim the combination of the spring and pendant tapered arm with the vibrating bobbin arm, arranged and operated in the manner and for the purpose herein set forth, or in any other way which may be considered substantially the same, and by which analogous results shall be produced: that is to say, any arrangement wherein a rubbing pressure is imparted to the arms, or their equivalents, containing the journals of the bobbin for producing the effect herein stated; said arrangement preventing the sudden rebounding of the bobbin on the shaft, when it becomes uneven from any cause which the mere spring and weight applied to the bobbin axle or its arms will not prevent, as I have fully tested by experiment,—the spring, when used alone, being too elastic, and the weight too dead, whereas the combination of the two causes the bobbin to rise and fall gradually, as herein fully set forth."

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73. For an *Improvement in Fastenings for Bureau Drawers;* George Wode, Elizabethport. Essex county, New Jersey, July 30.

The patentee says,—"The nature of my invention consists in so constructing the drawers of a bureau or other piece of cabinet furniture, that when all are closed but the topmost one. the shutting of that will cause all the others to be locked in that closed position, so that no one of them can be opened until the topmost one is partially withdrawn."

Claim.—"What I claim as my invention, is, 1st, the metallic strip or its equivalent, constructed with the notch for receiving the fastening bolt, as set forth.

"2d, The locking bolt, operated by the opening or closing of any one of the drawers, for the purposes herein named; the whole being constructed substantially in the manner herein set forth."

Designs for July, 1850.

1. For a *Design for Stoves;* Johnson & Cox, assignees of Joshua Crandall, Troy, New York, July 2.

Claim.—"What I claim is the design of cook stove represented in the drawings."

2. For a *Design for Stoves;* Calvin Doane, Braintree, Norfolk county, Massachusetts, July 9.

Claim.—"What I claim is the ornamental design herein described, for the front and back plates of a horizontal cylindrical air tight, and the door of the former consisting of scallop shells and razor shells, cast in alto relievo in the several positions on said plates specified and represented in the drawings."

3. For a *Design for Lamps;* Ellis S. Archer and Redwood F. Warner, Philadelphia, Pennsylvania, July 9.

Claim.—"We claim the ornamental design of the column or pedestal, the oil cup, and the border round the globe holder, set forth in the accompanying drawing, as our original design."

4. For a *Design for Stoves;* Sherman S. Jewett and Francis H. Root, Buffalo, New York, July 9.

Claim.—"What we claim is the shape and configuration of the ornamental plates for stoves herein described."

5. For a *Design for Stoves;* A. C. Barstow & Co., assignees of Apollos Richmond, Providence, Rhode Island, July 16.

Claim.—"What I claim, is ornamenting the several mouldings of the top and bottom of a pyramid stove, and the double doors resting on the latter, with transverse, longitudinal, and clustered beak-heads, cast in alto relievo, as described and represented in the drawings."

6. For a *Design for Stoves;* James McGregor, Wilton, New York, assignee of J. H. Conklin and A. W. Jones, City of New York, July 22.

Claim.—"We claim the design which is fully set forth in the drawings accompanying this description."

7. For a *Design for Stoves;* Job E. Owens, Jacob Ebert, and Elbridge G. Dyer, Hamilton, Butler county, Ohio, July 22.

Claim.—"What we claim, is the combined ornamental design and configurationof plates for a cooking stove, substantially as herein set forth, and represented in the accompanying drawings."

8. For a *Design for a Portable Grate;* Amos Paul, South New Market, Rockingham county, New Hampshire, July 22.

Claim.—"What I claim is the new design herein described, for the front plate of a portable grate, consisting of the five-centred arch moulding, supported by the triple column pilasters, in combination with the gothic panels on each side of said pilasters, and three-sided panels on the horizontal part of the frame; said three-sided panels, and the space beneath the arch moulding, being filled with the wedge-shaped radial ribs, all as herein described."

List of American Patents which issued in August, 1850, with Exemplifications by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in the Manufacture of Raw Hide Whips;* Thomas J. Barnes, Lowell, Massachusetts, August 6.

Claim.—"What I claim as my invention, is the described improvement in the manufacture of whips, or a whip having its external covering, as well as it Turks' heads or buttons, made in whole or in part of corrugated strips or bands of raw hide, laid or woven together, and on the handle or stock, substantially as specified."

2. For an *Improvement in Scrapers used by Cabinet Makers;* Hiram Carver, Edinburgh, Shenandoah county, Virginia, August 6.

Claim.—"What I claim as my invention, is the scraper stock, set in a frame for holding and guiding the scraper, so that the forward end only of the frame shall rest on the surface to be scraped, and thereby enabling the workman to manage the tool with the whole hand, and apply a steady force, instead of using the fingers only, as heretofore, for that purpose.

"2d, I also claim reversing the position of the scraper-stock, and plate in the stock-frame, whereby I am enabled to use both feather edges or corners of the plate successively without taking the plate from the stock, as set forth."

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3. For an *Improvement in Seed Planters;* Edson Hart, New Albany, Floyd county, Indiana, August 6.

Claim.—"What I claim as new, is the combined operation of filling and discharging the revolving cups or cavities in the planting rollers by a single blow of the arms on the said rollers, substantially as set forth."

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4. For an *Improvement in Ballot Boxes;* John R. Cannon, Hiltonsville, and Abner Hobbs, Greensburg, assigness of Joseph A. Hill, Bloomington, Monroe county, Indiana, August 6.

Claim.—"What I claim as new, is the arrangement substantially as described, of a moving band or tape, imprinted with numerals, and actuated by pedals, ratchet movement, and rollers, or other equivalent device, in connexion with spring detention latches and a liberating brake, or their equivalents, so that while the number polled for each respective candidate is exhibited by the appropriate tape, each pedal, as it is brought into play by the voter, is detained by its respective latch until again liberated by the attending officer, thus effectually preventing the duplication of votes."

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5. For an *Improvement in Processes for Amalgamating Gold;* Calvin C. Knowles, Lowell, Massachusetts, August 6.

The patentee says,—"The improvement in the separating process which I have discovered consists in applying to the sand or pulverized quartz, with which the gold is connected or intermingled, a solution of chloride of sodium and tartaric acid in soft water. The chloride of sodium and tartaric acid should be mixed together in about equal proportions, and one ounce of the mixture makes a suitable solution in one quart of water."

Claim.—"What I claim as my discovery, is saturating or dampening the sand or quartz with which gold is found with a solution, in soft water, of chloride of sodium and tartaric acid, mixed in about equal proportions, and applied to the sand, &c., prior to the introduction of quicksilver, to effect amalgamation with the gold."

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6. For an *Improved Method of Making Barrels for Fire Arms;* Jesse Pannabecker, Elizabeth township, Lancaster county, Pennsylvania, August 6.

Claim.—"What I claim as my invention, is making barrels for fire arms with a double seam or weld, from two bars of metal previously rolled into a semi-circular form; the whole operation being conducted as described."

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7. For an *Improvement in Hanging and Operating Gates;* Thomas Parkinson, Naples, Ontario county, New York, August 6.

The patentee says,—"The nature of my invention consists in a gate of two separate parts of equal size, sufficiently large to fill the required opening, and which are severally opened with the hand, assisted by weights, throwing them over upon an axis placed at the outer lower corner of each half of the gate."

Claim.—"What I claim as my invention, is the manner of hanging and operating the gates, substantially as described."

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8. For an *Improvement in Tenoning Machines;* E. M. Shaw, Baltimore, Maryland, August 6.

The patentee says,—"My machine is constructed to cut a tenon, by removing the wood from either or both faces of the piece of wood on which the tenon is to be made, by means of two reciprocating planes, whose irons are connected in such manner with their respective stocks that they act upon the wood during their direct stroke, while during their retrograde stroke their cutting edges are moved back from the surface from which the shaving has been removed by their direct stroke, thus preventing the edges of the plane irons from being dulled by rubbing or grinding over the surface of the timber in the retrograde stroke of the planes."

Claim.—"What I claim as new, are the planes for cutting the tenons, whose irons are made to turn alternately from and towards the faces of their respective stocks, so as alternately to cut and clear the lumber on which they are acting."

9. For an *Improvement in Churn Dashers;* Robert S. Sherman, Napanock. Ulster county, New York, August 6.

The patentee says,—"My improvements consist in constructing the concave dasher or bottom plate with four or more, inverted funnel-shaped tubes, projecting upward and outward therefrom, at equal distances apart, and concentric to the circle of the concave dasher or bottom plate, there being openings in said concave dasher corresponding with the funnel-shaped tubes; and, in connexion with these tubes, arranging four or more radial wings or plates around the staff of the dasher, whose outer edges are inclined upward and outward directly over the upper or smaller ends of the funnel-shaped tubes, and having a circular cap plate or disk placed over their upper edges, of a circle greater than the circle of the funnel-shaped tubes, by which arrangement, on the descent of the dasher and staff, the cream will be forced upward through the openings in the concave dasher and inclined tubes in streams, against the inclined edges of the radial wings or plates, and divided and deflected, or thrown out, by the cap plate or disk, nearly horizontally against the sides of the churn tub."

Claim.—"All that I claim is the combination of the funnel-shaped tubes, radial wings or plates, inclining upward and outward directly over the ends of the tubes, with the circular cap plate or disk, for the purpose as described."

10. For an *Improvement in Harness Saddles;* Robert Spencer, Brooklyn, New York, August 6.

Claim.—"What I claim as my invention, is the combination of separate elastic plates with the skirt portions of the casting and the pads, substantially in the manner set forth, for the purpose of causing the pads to have a springy and equable bearing upon a horse, and to adapt themselves to horses of different sizes and conditions."

11. For an *Improvement in Machines for Beating Gold;* William Vine and James H. Ashmead, Hartford, Connecticut, August 6.

Claim.—"What I claim as my invention, is the combination of the adjustable differential cams with the pendulums, by means of which the packet is shifted under the hammer, so as to regulate the distribution of the blows upon it, as herein set forth."

12. For *Improvements in Machinery for Dressing Weavers' Harness;* Kassimir Vogel, Westbrook, Cumberland county, Maine, August 6.

Claim.—"What I claim as my invention, is the within described combination of the size or glue receptacle and the rotating brushes with each other and with the shafts, the screw shafts, the sliding rod, the lever, the clutch, the pulleys, and the driving pulley, by which the brushes are made simultaneously to rotate on their axes, and to alternately traverse from one end of the harness to the other, (or any portion of it,) and deposit the size or glue evenly and smoothly upon the threads of the harness; substantially as set forth.

"In combination with the size or glue receptacle, and the rotating and reciprocating brushes above set forth, I also claim the imparting a reciprocating movement to the frame in which the harnesses are placed, simultaneously with the combined movements of the said brushes, substantially in the manner set forth.

"I also claim the making the sliding frame of such shape and capacity as to receive two sets of harness, when it is combined with the shaft, the pulley, the crank or lever, the elastic lever, the pitman, and the crank wrist, substantially as set forth, by which, without stopping the machine, a dressed harness can be removed from the frame, and an undressed harness secured in its place, whilst another harness is being dressed with size or glue in the opposite receptacle of the said frame, substantially in the manner set forth."

13. For an *Improvement in Churn Dashers;* William and Matthew C. Walker, Lancaster, Pennsylvania, August 6.

Claim.—"What we claim as our invention, is the double curved S-shaped dasher, with the grooved pieces in combination, as herein described for the purposes set forth."

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14. For an *Improvement in Cooking Stoves;* Jame White, Milton, Northumberland county, Pennsylvania, August 6.

Claim.—"What I claim as my invention, is, 1st, the manner of forming the front diving flues on either side of the stove, by recessing the centre of the front plate above and beneath the plate forming the hearth and bottom of the fire chamber, and inserting plates to form the insides of the flues in the fire chamber, so that they can be replaced when burnt out, without disturbing the sections of said plates below the hearth, as described."

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15. For *Improvements in Tenon Bitts;* Eli K. Wisell, Warren, Trumbull county, Ohio, August 6.

The patentee says,—"My invention consists of a tenoning tool or bit of peculiar construction, which is adapted to an ordinary boring brace, and is composed of converging slides, in combination with a pair of planes, which embrace the extremity of the spoke, and which, as the brace is turned and forced endwise toward the spoke, are caused to approach each other, thus reducing and rounding its extremity until the space between the plane irons is equal to the diameter of a finished tenon, when their closer approximation is stopped by gauges secured to their opposite faces."

Claim.—"What I claim as my invention, is the combination of converging slides with a pair of planes, the latter being combined with the former in such a manner that, by pressure and turning, they are caused to approach each other, and reduce the extremity of the spoke to which they are applied, substantially as herein set forth, the slides and planes being turned by a hand brace or by machinery."

To be continued.

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Investigation of the Comparative Merits of the Perpendicular and Radial Paddle Wheels for Sea-Going Vessels. By B. F. Isherwood, Esq., *Chief Engineer, U. S. Navy.*

Continued from page 139.

Let us suppose, now, the same depth of immersion for the radiating paddle wheel, whose arm, as before, with a radial paddle at its extremity, is just entering the water at an angle of 45°, and having, as before also, the same less horizontal velocity than the velocity of the vessel. There is now no loss of reactionary force, but there is the loss by oblique action; and as the angle is 45°, it follows that half the force applied to the paddle is expended in lifting the vessel. This result, however, as with the perpendicular paddle, is too minute to be appreciable. The proportion, now, of this lifting force to the total power applied to the paddle under consideration, is 50 per cent.—with the perpendicular paddle 25 per cent., to which must be added 25 per cent. by reactionary loss. Hence there would be no superiority, economically, of the particular perpendicular paddle under consideration over the radial paddle, at this maximum immersion, in practice; but they would exactly equal each other, supposing, of course, the same horizontal velocity for each, and that horizontal velocity equally less than the velocity of the vessel.

This equality of loss is true, however, but of three positions of the paddles, viz., when the arm carrying them is either horizontal or vertical, or intermediate: that is, at 45°. In the first case, the wheel would be immersed to its axis; then, the radial paddle coinciding with the arm, all the power applied to it would be expended in vertical pressure only; and the perpendicular paddle at right angles to the arm, would cause a loss of the whole reactionary force applied to it. In the second case, both paddles would expend the whole power applied to them in the propulsion of the vessel. In the last case, as has already been shown, the loss of reactionary and lifting force by the perpendicular paddle, and by oblique action of the radial paddle, is equal, and amounts in both to 50 per cent. But this equality does not exist at any point between the angle of 45° and a horizontal and a perpendicular position, and this results from the fact that the loss of labor by reaction and lifting, is in proportion to the *sines* of the angles, while the loss by oblique action is in proportion to the *squares* of the same sines.

Supposing, now, the purely imaginary case where the vessel has a greater velocity than the horizontal velocity of the paddle having the greatest horizontal velocity, and the wheel to be immersed to its axis; we should then have the following losses by the two kinds of paddles, calculating the reactionary and lifting loss by the perpendicular paddle as the sines of the angles, and the oblique action loss by the radial paddle as the squares of the sines of the same angles,—supposing the arms of the two wheels the same in number, and to be in corresponding positions.

Angle of arm with surface of water.	PERPENDICULAR PADDLE.	RADIAL PADDLE.		
	Loss by reaction and lifting.	Loss by oblique action.	Difference in favor of perp'r paddle.	Difference in favor of the radial paddle.
	per cent.	per cent.	per cent.	per cent.
0° or horiz'tl.	100	100	0	
5°	92	99	7	
15°	79	93	14	
25°	68	82	14	
35°	59	66	7	
45°	50	50	0	0
55°	41	34		7
65°	32	18		14
75°	21	7		14
85°	8	1		7
90° or perp'lar	0	0		0
Totals,	450	450	42	42

In the above supposed case, then, we perceive there would be no choice between the two kinds of paddles, as they operate equal losses,—the sum of the losses of each being equal and expressed by the number 450. Moreover, we perceive that, in going from 0° to 45°, the losses by the perpendicular paddle are less than by the radial paddle by the number 42; and that, in going from 45° to 90°, the losses by the radial paddle are less than by the perpendicular paddle by the same number, 42; further, that at midway between 0° and 45°, and 45° and 90°, the difference is at its maximum. Our supposed case is wholly an impossible one, but is adduced to explain the different actions of the two kinds of wheels. Practically, we must confine ourselves to the consideration of the mean case, where the wheels have an immersion of $5\frac{1}{2}$ feet, and a slip of 20 per cent.

Referring now to our wheel of 28 feet diameter, $5\frac{1}{2}$ feet immersion, and 20 per cent. slip, the paddles would begin to enter the water when the arm bearing them made an angle of about 35° with the surface of the water, and would come into propelling action when the same arm made an angle of about 50° with the surface of the water. How would the proportion of losses by the two kinds of paddles now stand?

Premising that the loss by oblique action begins when the radial paddle enters the water, and continues till it reaches a vertical position, and that the reactionary loss by the perpendicular paddle is confined between the points where it enters the water and where it comes into propelling action, and that the amount of power applied to each *whole* paddle, in each position taken, equals unity or 100, the paddles acting during equal times, and if but a *fraction* of the *whole* paddle act, then the power applied to it will be that fraction of 100; and if the paddles act during unequal times, then the power applied to each will be in the proportion of the time it acts. Now from the angle of 35° to 90° we have taken six positions, in only the last four of which, however, the whole paddle acts during equal times. In the first position only about $\frac{1}{8}$th of the whole paddle acts, and that but for half the times of the others; the power applied to it will then be $\frac{1}{16}$th of 100. In the second position only about $\frac{1}{2}$ of the whole paddle acts; the power applied to it will then be $\frac{1}{2}$ of 100. The whole power applied will therefore be represented by $400+6\frac{1}{4}+50=456\frac{1}{4}$. The reactionary loss obtains for the first and second positions only, and for the first position, (taking the per cents. of loss from the foregoing table,) will be $\frac{1}{16}$th of $59=3{\cdot}7$. For the second position $\frac{1}{2}$ of $50=25$; total, $3{\cdot}7+25=28{\cdot}7$. Then the whole power applied being represented by 456·25, the whole power expended in reaction and lifting will be represented by 28·70, or 6·3 per cent. nearly. The difference in favor of the perpendicular paddle over the radial paddle is therefore $18\frac{1}{3}-6{\cdot}3=12$ per cent. in round numbers. From this 12 per cent. must be deducted the per centage of power absorbed in the friction of the eccentric strap, and journals of the levers of the perpendicular paddle wheel. That per centage of friction can only be determined by experiment. Taking it, however, at 10 pr. ct. we perceive that, with equal slips, viz., 20 pr. ct., which is about the least that it is advisable to give, or is given in practice, and with a depth of immersion of $5\frac{1}{2}$ feet for a 28 feet diameter wheel, which is the maximum mean immersion for the largest steam ships making long voyages, the perpendicular paddle exceeds the radial paddle economically by 2 per cent. If the slip be varied from 20 per cent. so as to become greater, or if the immersion be increased beyond the proportion of $5\frac{1}{2}$ to 14, (the radius of the wheel,) the per centage in favor of the perpendicular paddle will be greatly increased. The only conditions under which a superiority can be given to the radial paddle are those of small immersion and small slip.

The per centage of loss by friction with the perpendicular wheel having been determined, and being allowed for, a simple calculation, similar to that above given, will easily ascertain the relative excellence of the two kinds of paddles in any given cases, when the slip and immersion of each are known.

I shall now proceed to determine this friction from such data as I am possessed of, on vessels using the two different wheels. For this purpose I have selected two vessels whose performances are given by the English Admiralty at a measured mile in the Thames River. The dimensions of the vessels are as follows:—

	"BLACK EAGLE." Perpendicular Paddle.	"TRIDENT." Radial Paddle.
Hulls.		
Length on deck,	155 feet.	195 feet.
Beam "	26 "	31 "
Depth of hold,	14 5-6 feet.	18 "
Mean draught of water,	10½ "	11 "
Displacement,	600 tons.	900 tons.
Immersed amidship section,	200 sq. feet.	252 sq. feet.
Paddle Wheel.		
Effective diameter,	20·25 feet.	20·67 feet.
Radius of circle of centre of reaction,	9·60 "	9·77 "
Radius of rolling circle,	7·75 "	7·59 "
Breadth of paddle,	4·17 "	2·00 "
Area of one paddle,	22·90 "	18·00 "
Immersion of lower edge of paddle,	4·96 "	2·08 "
Engines.		
Number of steam cylinders,	2	2
Diameter,	62 inches.	70¾ inches.
Stroke of piston,	4½ feet.	5 feet.
Number of double strokes per minute,	23¾	22
Mean effective steam pressure in the cylinder throughout stroke,	17 lbs.	17 lbs.
Actual horses power developed by engines,	665	891
Speed of vessel in statute miles per hour,	13·14	11·92

The calculations we are about to make, have for their object the determination of the friction of the lever journals, and of the eccentric strap of the perpendicular paddle, in per cents. of the total power developed by the engine. To effect this there must be calculated for the two vessels the losses, (omitting the friction loss by the perpendicular paddle wheel,) by their respective paddle wheels, viz., in the "Black Eagle" by slip and reaction, and in the "Trident" by slip and oblique action. To these must be farther added the power, in per cents., which has been found in practice required to work the engine, and to overcome the friction of the load. The remainder of the power will be considered as that utilized in the propulsion of the vessel. The vessels, however, are of different dimensions, and the power required to propel them at equal speed will be as their resistances multiplied by their respective immersed amidship sections. These resistances will be in the compound ratio of their immersed amidship sections and displacements. The previous remainder of the power being multiplied by these coefficients of resistance inversely, will represent the powers proportionally to the resistances they overcome. The final comparison is now readily made, by taking these proportional powers as the measure of the powers, and the cubes of the speeds of the vessels as the measure of the effects.

If now our data were exactly correct, and there were no loss of labor by the friction of the perpendicular paddle wheel, the final comparison would show, in each case, the powers to bear equal proportions to the cubes of their respective speeds; assuming the data to be correct, there will remain the loss by friction of the perpendicular paddle wheel included in the final comparison, which will then *not* show the powers to bear equal proportions to the cubes of the speeds, and the discrepancy is the measure of the power absorbed in the friction of the perpendicular paddle wheel.

Let us make these calculations, and first for the perpendicular paddle wheel of the "Black Eagle."

Speed of vessel per hour, 13·14 statute miles, or	69379·20	feet.
Speed of centre of reaction, ...	85954·18	"
Slip, ...	16574·98	" or 19·3 pr. ct.

Loss by reaction, calculated as before described, between the surface of the water and a horizontal line tangential to the lowest point of the rolling circle, (the circumference of which circle multiplied by the number of revolutions of the paddle wheel equals the speed of the vessel,) is 6·7 per cent. of the total power.

The power required to work the engine, overcome load or air pump, &c., may be taken at 2 lbs. per square inch of steam piston, or, in round numbers, at 12 per cent., the mean effective pressure on the steam piston being 17 lbs. per square inch.

The power required to overcome the friction of the load on the engine, according to the best experiments, is 10 per cent. We then, for the disposition of the power with the "Black Eagle," have the following:

	Per Cent.		Actual Horses Pow'r
Slip of the centre of reaction of the paddles, .	19·3	or	128·345
Reaction of water on the paddle, . . .	6·7	or	44·555
Working engine, &c., &c., ...	12·0	or	79·800
Overcoming friction of load, ...	10·0	or	66·500
Utilized in propelling vessel, including amount absorbed in friction of working parts of wheel, . .	52·0	or	345·800
Totals, . . .	100·0	or	665·000

The disposition of power with the "Trident" being calculated as follows, viz., the slip as the difference of speed between the centre of reaction of the paddle and the velocity of the vessel, and the loss by oblique action as the squares of the sines of the angles under which the paddle presses the water, from the surface of the water to a perpendicular position, and the mean taken; and the same allowance for working the engine, overcoming friction of load, &c., being made as for the "Black Eagle," we have:

	Per Cent.		Actual Horses Pow'r
Slip of the centre of reaction of the paddle, . .	22	or	196·02
Oblique action of the paddles, ...	8	or	71·28
Working Engine, &c., &c., ...	12	or	106·92
Overcoming friction of load, ...	10	or	89·10
Utilized in propelling vessel, ...	48	or	427·68
Totals, ...	100		891·00

The coefficients of resistance for the hulls will be obtained as follows: The vessels having about the same proportions between length and beam, their resistances (that is, the relative resistances of their models) may be considered as their displacements and immersed amidship sections. That this proportion gives the relative resistances of the vessels in function of model (not *absolute* resistances) is easily proven.

Suppose two vessels with the same proportions between length, breadth, and depth, and having the same models, but the immersed amidship section of one is 100 square feet, and its displacement 500 tons; the immersed amidship section of the other is 300 square feet, and as the models are alike, its displacement will have the same proportion to the displacement of the other as its immersed section has to the immersed section of the other: that is, as 3 to 1. The comparison of the relative resistances of these vessels in function of model will then be thus: 100 : 500 :: 300 : 1500, and $100 \times 1500 = 500 \times 300$;—that is, the resistances in function of model are the same, and the immersed amidship sections being as 3 to 1, the absolute resistance will be in the same proportion; because the immersed amidship sections represent the quantities of water moved, and the relative resistances in function of model, represent the resistances of that water to being moved.

Applying this to the "Black Eagle" and "Trident," we have:

$$600 : 200 :: 900 : 252, \quad \text{and}$$
$$600 \times 252 : 900 \times 200 :: 1{\cdot}00 : 1{\cdot}19.$$

To obtain the *absolute* resistances of the vessels, the above resistances in function of model must be multiplied by their respective immersed amidship sections. This product represents relatively the proportions of power required to propel the vessels at equal speed. The immersed amidship section of the "Black Eagle" is 200 square feet,—of the "Trident" 252 square feet; and 200 : 252 :: 1·00 : 1·26, and $1{\cdot}26 \times 1{\cdot}19 = 1{\cdot}50$, and $1{\cdot}00 \times 1{\cdot}00 = 1{\cdot}00$; that is, the absolute resistance of the "Black Eagle," comparatively to that of the "Trident," is as 1·00 to 1·50.

To return now to our calculations, we find that the number of actual horses power required to propel the "Black Eagle," (including the amount absorbed in friction of the working parts of the wheel,) was 345·80, and the number of actual horses power required to propel the "Trident" was 427·68; and multiplying these powers by the coefficients of the resistances of the vessels inversely, we have $345{\cdot}80 \times 1{\cdot}50 = 518{\cdot}70$ or 1·0000, and $427{\cdot}68 \times 1{\cdot}00 = 427{\cdot}68$ or 0·8245.

These last numbers represent the powers proportionally to the resistances they overcome. But they overcome these resistances at different speeds, viz., the "Black Eagle" at 13·14 statute miles per hour, and the "Trident" at 11·92 statute miles per hour. Now powers compare as the cubes of the speeds of the resistances they overcome, $13{\cdot}14^3 : 11{\cdot}92^3 :: 1{\cdot}000 : 0{\cdot}7466$. We have, therefore, for the final comparison,

	"Black Eagle."	"Trident."
Powers,	1·000	0·8245
Effects,	1·000	0·7166

And 82·45 : 7466 :: 1·000 : 0·9055.

That is to say, the result of the application of the power in the "Black Eagle" is better in the proportion of 1·0000 to 0·9055 than in the "Trident," according to the calculation, and the calculation includes as utilized power, in the "Black Eagle," the power necessarily absorbed by the friction of its perpendicular paddle wheel. But as allowance for the different resistances of the hulls has been made, the discrepancy in the calculation is produced by, and is equal to, the power absorbed in this friction, and this discrepancy is 1·0000 — 0·9055 = 0·0945, and 0·0945 is $9\frac{45}{100}$ per cent. of the total power, 1·0000, of the "Black Eagle;" $9\frac{45}{100}$ per cent. of the total power is, therefore, the loss by friction of the perpendicular paddle wheel of the "Black Eagle."

Assuming this to be correct, let us see if it will give the same result, making the comparison in another manner, viz., by per cents. utilized of the total power. Taking the total power in each case as unity, or 100·00, we have for the "Black Eagle" the following losses, viz., by slip 19·3, reaction 6·7, working engine 12, friction of load 10, and friction of wheel 9·5; total 57·50, which, deducted from 100·00, leaves 42·50 per cent. utilized. With the "Trident" we have the following losses, viz., slip 22, oblique action 8, working engine 12, and friction of load 10; total 52, which, deducted from 100, leaves 48 per cent. utilized, and 48 : 42·5 :: 1·0000 : 0·8854, or nearly the same proportions as before, which were 1·0000 : 0·9055. The calculation may, therefore, be considered as very nearly correct.

It will be observed that the per cents. of power utilized in the "Black Eagle" were only 42·5, while in the "Trident" they amounted to 48; but the paddles of the "Trident" were only *awash:* that is, having the upper edge coinciding with the surface of the water, an arrangement not practicable for a sea-going vessel. Supposing the paddle of the "Trident" to have had a sea-going immersion: that is, about $\frac{4}{10}$th of the radius of the wheel, and to have had such a surface as to have made the slip the same as for the "Black Eagle," viz., 19·3 per cent., the oblique action in that case would have amounted to $18\frac{1}{3}$ per cent. If, now, to these losses be added those by friction of load, 10 per cent., and working engine, 12 per cent., we shall have a total of 59·6, which, deducted from 100, leaves 40·4, which is an inferiority of 2 per cent. Beside this 2 per cent. economically, there is the important advantage that the perpendicular paddle wheel would have—less bulk and weight; and the bulk and weight can be still further reduced by increasing the slip, and consequently decreasing the loss by reaction.

The loss by reaction amounted to 6·7 per cent. Let us now increase the actual slip, 19·3, making it 25 per cent. With this slip the reactionary loss would be about 2·8 per cent., to which add the 25 per cent. slip, 10 per cent. for friction of load, 12 per cent. for working engine, and 9·5 per cent. for friction of wheel's eccentric strap and levers' journals, and and we have a total of 59·3, which, deducted from 100, leaves 40·7 per cent utilized, almost exactly the same as utilized with a radial paddle wheel of 19·3 per cent. slip, and a loss of $18\frac{1}{3}$ per cent. by oblique action, being the loss normal to a sea-going immersion.

With these proportions of losses, we perceive the two kinds of paddle wheels are economically equal, but there remains a great practical superiority in favor of the perpendicular wheel from its greater slip, viz., its still greater reduced bulk and weight normal to the increased slip; and as this reduction in its paddle surface can be made wholly in the direction of length, its practical value is of high importance. Let us ascertain the amount of this reduction.

Premising that the propelling efficiency of propelling surfaces is as the squares of the speeds with which they strike the water; and supposing a certain speed of vessel to be given with a certain propelling surface, 1·00, having a velocity of 1·00, and a slip of 19·3; now what amount of surface would be required to propel the vessel at the same velocity but with a slip of 25? Supposing the centre of reaction of the paddle wheels to be of equal diameters, it is evident that the number of revolutions to give the vessel equal speeds with the unequal slips, 19·3 and 25, will be as the slips. The velocities of the propelling surfaces will therefore be as 19·3 and 25, or as 1·0 to 1·3, the squares of which are 1·00 and 1·69. Then 1·69 : 1·00 :: 1·00 : 0·59; that is, there would only, with the 25 per cent. slip, be required $\frac{59}{100}$ of the paddle surface required for the 19·3 per cent. slip, and this reduction being made in the length of the paddle, would reduce the length of the "Black Eagle's" paddle from 5½ feet to 3¼ feet,—a very valuable practical result.

A practical advantage resulting from increased slip, is that the same engine can develop a greater power, and give the vessel a greater speed, or a less engine develop an equal power. The saving is obviously in the first cost of engine, and in its less bulk and weight in the ship. We should, therefore, give all the slip possible, *keeping the sum of the losses a minimum.* If increased slip be given without its reducing in a nearly equal degree some other loss, its advantages are obtained at a waste of fuel equal in per cent. to the increase of slip.

Our general conclusion is, then, that for sea-going vessels of medium size and a 9 days' voyage, the perpendicular paddle wheel possesses decided advantages over the radial paddle wheel, both economically, potentially, and in view of the practical advantages of less strain upon the machinery and ship,—less weight and more equable action.

Washington, July 5, 1850.

Translated for the Journal of the Franklin Institute.

On Malleable Brass. *By* Dr. L. Elsner.

It is known that common brass, containing from 27·4 to 31·8 per cent. of zinc, and from 71·9 to 65·8 per cent. of copper, is not malleable while hot, but that articles of it must be made by casting. As it would be of great importance in many branches of industry to have an alloy of this kind that could be worked while hot, like malleable iron, the information that such an alloy exists must be welcome to artists. As far as I know, the first specimens of malleable brass came from England to Hanover, and the first account of the analysis of this alloy was published by the *Gewerb-Verein* of Lower Austria, at Vienna. The results gave a composition of 34·76 zinc and 65·03 copper, with traces of lead.

On the basis of this analysis M. Machts, proprietor of a manufactory, made larger specimens of the alloy in question, and found that, by melting together 33 parts of copper and 25 parts of zinc, there was a loss of three parts; thus making 60 per cent. copper and 40 per cent. zinc. It differs from the English specimens by containing a larger proportion of zinc, and possesses, according to M. Machts, the precious property of malleability in a higher degree than the English specimens.

A piece of "*yellow metal*," similar in color to this alloy, was found, on analysis, to contain 60·16 copper and 39·71 zinc, which is the composition of malleable brass. It also showed great density or solidity.

I caused an alloy to be made by melting together 60 parts copper and 40 parts zinc, which had the following properties: The color was between that of brass and tombac, it had a strong metallic lustre, a fine, close-grained fracture, and great solidity, (density.) Its specific gravity at the temperature of 10° Celsus, was 8·44;—by calculation it should only have been 8·08, thus showing that in the formation of the alloy a condensation must have taken place. Calculation shows that the alloy may be considered as a determinate chemical combination, for the results of the analysis very nearly accord with the assumption that it may be considered as composed of 3 atoms by weight of copper, and 2 atoms by weight of zinc, ($3\ Cu + 2\ Zn$.) The hardness of the alloy is the same as that of fluor spar; it can be scratched by apatite, (glass,) consequently its hardness is $=4$. The alloy is harder than copper, very tough, and is, in a properly managed fire, malleable; so much so that a key was forged out of a cast rod.

These important properties of this alloy warrant an expectation of its application to many purposes in the arts, and it would appear that they depend on its definite chemical proportions. Agreeably to the directions of M. Feyerabend, care must be taken in melting together the metals, not to permit too great a loss of zinc to take place, lest the proportion between the metals should be altered, which might not be without effect on the important properties of the alloy. With this view, it might be advantageous in practice, in place of zinc, to add, in melting, proportionate mixture of brass to the proper proportions of copper. An alloy prepared in this way gave, on analysis, 61·44 copper and 38·15 zinc. It is very probable that malleable brass will hereafter, in many cases, be made use of instead of the higher priced copper.—*Verhandlungen des Vereins zur beförderung des Gewerbfleisses in Preussen*, 1849.

For the Journal of the Franklin Institute.

The Koechlin Turbine.

The hydraulic motor known by this title, and mentioned in this Journal, *Vol.* IX., 3*d series*, *p.* 222, has just been introduced in this vicinity by Mr. E. Geyelin, at the powder works of the Messrs. Dupont, near Wilmington, Del.; and at his request, a trial was recently made by certain members of the Institute, to determine the practical coefficient of the wheel. We now propose, for the benefit of those interested, to report the results to the readers of the Journal.

The turbine experimented upon is intended to produce 7 horse power under a fall of 10 feet, and to drive the machinery of the new mixing mill at the lower works. It is $21\frac{1}{4}$ inches in diameter, $3\frac{1}{2}$ inches deep, and is to make 190 revolutions per minute, giving $63\frac{1}{3}$ revolutions of a horizontal shaft to which it is geared 3 to 1. To this shaft was attached a Prony dynamometer, whose lever was 7·96 feet long, giving 50 feet circumference. At the time of the experiments, a wooden box, nearly water-tight, was placed in the tail race, surrounding the lower part of the wheel. One side of it was cut away, forming a waste-board 3·83 feet wide, over which the water was discharged; and at the same time diminishing the usual head and fall about 9 inches.

Experiment No. 1.—The distance between the level of water in the penstock or forebay, and that of the bottom of the waste-board, was 10′ 1″, and the depth of water flowing over the waste-board $8\frac{1}{8}''$, leaving the actual head and fall $10'{\cdot}1'' - 8\frac{1}{8}'' = 9',\ 4\frac{7}{8} = 9{\cdot}34$ feet. By Morin's formula, (*Aide Memoire, p.* 37,) $Q = m L h \sqrt{2gh}$; Q being discharge per second, *m* the constant which, for ·74 depth, = ·383, L = width of waste-board, = 3·83 feet, and h = depth of water upon it, = ·74. Then in this case $Q = {\cdot}383 \times 3{\cdot}83 \times {\cdot}74 \sqrt{64 \times {\cdot}74} = 7{\cdot}468$ cubic feet, and the theoretical power due to the water was $7{\cdot}468 \times 62{\cdot}5 \times 9{\cdot}34 \times 60 = 261{,}537$ lbs. raised 1 foot per minute = 7·92 horse power.

It was found that, at 63 revolutions per minute of the horizontal shaft, 63 lbs. balanced the lever. Hence the power developed by the wheel was $63 \times 63 \times 50 = 198{,}450$ lbs. = 6·014 horse power.

Experiment No. 2.—The gates from the head race were so far closed as to reduce the head 1 foot, and maintain it at that level during the experiment. The depth of water on waste-board was $8\frac{1}{8}''$, so that the head and fall was $9'{\cdot}1'' - 8\frac{1}{8}'' = 8'{\cdot}4\frac{7}{8}'' = 8{\cdot}41$ feet. Therefore, by the same formula, *m* being ·39 for this depth, $Q = {\cdot}39 \times 3{\cdot}83 \times {\cdot}677 \sqrt{64 \times {\cdot}677} = 6{\cdot}66$ cubic feet, and the theoretical power due to the water was $6{\cdot}66 \times 62{\cdot}5 \times 8{\cdot}41 \times 60 = 210{,}000$ lbs. raised 1 foot per minute = 6·36 horse power.

It was found that 63 lbs. balanced the lever at 49 revolutions per minute of the shaft. Hence the power developed by the wheel was $49 \times 63 \times 50 = 164{,}350$ lbs. = 4·98 horse power.

The coefficients are then, for Experiment No. 1, $\frac{6{\cdot}014}{7{\cdot}92} = .760$ per ct.

Experiment No. 2, $\frac{4{\cdot}98}{6{\cdot}66} = {\cdot}783$ "

And, making allowance for leakage around the waste-board box, which was partially counterbalanced by the friction of the gearing and horizontal shaft, the useful coefficient of the wheel may be taken at 75 per cent., and, as has been seen, remains the same when the wheel is working at 5 horse power, which is but 70 per cent. of its full power.

For the information of those who are not familiar with this wheel, it may be stated that it is placed as near the top of the fall as possible, and revolves within a cast iron pipe leading below the level of the tail race. The "curved guides" are directly *over* the wheel, and may, therefore, be easily reached for cleaning or repair. These curved guides are disposed radially around a hub, curving spirally around it as they descend, in such a manner that any horizontal linear element of a guide is in a radial line drawn from the axis. The buckets of the wheel are similarly curved, but in an opposite direction.

Mr. Geyelin has made another small wheel for the Messrs. Dupont, and is also about to erect two of sixty horse power each for other parties in this vicinity. When they are ready for operation, a committee of the Institute will probably be called upon to examine them more carefully, and make a formal report upon their merits. M.

Translated for the Journal of the Franklin Institute.

On Galvanic Soldering. *By* Dr. L. Elsner.

By the term "*galvanic soldering*" is understood the junction of two separate pieces of metal by means of metal precipitated by the galvanic current. This experiment of soldering by the wet way has been for some time past recommended in technical journals, while on the other side, it has been asserted that an union of separate pieces of metals by this means could not be effected. In order to make this matter, so important to the arts, clear, I instituted the following experiments, the results of which speak favorably for galvanic soldering.

For carrying on the experiments, a "*bladder apparatus*" was made use of. As exciting fluids, there was used, on the one hand, a concentrated solution of sulphate of copper, with an excess of sulphuric acid, which occupied the exterior vessel; on the other, dilute sulphuric acid, which was contained in the inner portion, which is enclosed by a bladder. The block of zinc was plunged into the sulphuric acid, and a plate of copper parallel with the bottom of the bladder into the solution of sulphate of copper, both metals, of course, being connected by wires. On the plate of copper, which served as the negative electrode, was laid a ring of stout sheet copper, which was cut through at one point, (the distance between the two cut ends might amount to from about the $\frac{1}{4}$ to the $\frac{1}{6}$ of a line.) After several days, during which time the exciting fluids were repeatedly renewed, the space between the cut ends of the ring was found completely filled with precipitated metallic copper. Mr. Knoblandt, the engraver, had the kindness to file a portion of the ring at the spot in which the ring had been cut; moreover, the magnifying glass showed the homogeneous filling up of the cut portion with coherent solid copper.

A second copper ring was divided into two parts, and the two halves, with their cut surfaces placed in apposition, were subjected to the same galvanic action. After several days, the two half rings were found completely united into one ring at their point of contact by solid precipitated copper. In this instance, also, filing a portion of the ring at one of the former points of contact, showed that this space was completely filled and solidly united by perfectly homogeneous precipitated copper. On examining this spot with the glass, the perfect homogeneous connexion of the previously divided portions of the ring was very evident.

A third experiment was made in the following manner: Two rings of stout sheet copper were so placed directly over each other as to form a cylinder, consisting of the two rings; moreover, the rings were surrounded with a strip of tinfoil, and this was painted over with a solution of wax in oil of turpentine, so that both rings were equally surrounded with a conducting mould. The rings, thus arranged, were laid on the copper plate of the "bladder apparatus," and plunged in the solution of sulphate of copper. After several days, the inner sides of the rings were covered with a deposit of copper, and the points of apposition between both rings filled up with galvanically precipitated copper. The rings were no longer subjected to galvanic action, as but a moderately thick layer of copper was deposited on their inner sides; notwithstanding which, both rings were united into a completely solid cylinder. As a matter of course, the outer shell of tinfoil was removed before a trial was made of the solidity of the galvanic deposit. It is also to be remarked, that the rings, after being for some time in contact (during the galvanic action) with the plate of copper on which they reposed, were so firmly attached by the precipitated metallic copper as to require some application of force to separate them from it. All the experiments were exhibited at the meeting of the Society.

From the communication of the results of the foregoing experiments, it may be stated without any hesitation, that galvanic soldering is available to produce a solid connexion of separate portions of metal. Hence it follows, that the solid combination of separate moulded portions of metal into one entire form or figure, by means of galvanically precipitated metal, (usually copper,) must be practicable. There is reason to believe that a galvanic soldering would be effected by means of concentrated solutions of the salts of gold and silver, as is the case with solutions of the salts of copper. M. Von Hackewitz informed me that he had remarked in his works on a large scale, and also in the galvanic precipitations of silver, that even in these galvanic union of distinct and separate portions had taken place.

In prosecuting the before mentioned experiments, it was observed that when the galvanic action was too strong, and also when the current was too powerful, the negative copper electrodes, as well as the plate of copper and the copper rings resting on it, were covered with a dark brown coating, (as is well known to be the case under similar circumstances in galvanic gilding.) After many fruitless attempts to get rid of this brown coating, it was discovered that it could be easily and perfectly effected by immersing for some seconds, in a mixture of sulphuric and nitric acids, the articles thus coated. This brought out afresh the beautiful red color of the galvanically precipitated copper, and after the articles were thoroughly washed with water, and again subjected to galvanic action, a fresh precipitation of copper took place.

That galvanic soldering must have a practical application, may, in few words, be deduced on theoretical grounds. The articles are electro-negative, while the zinc is positive, consequently they are negative at the opposite points of section: *i. e.* subject to the same electric action; therefore, during the electrolytic decomposition of the metallic salt, (in the above instance sulphate of copper,) the separating electro-positive particles of copper are deposited on both the opposite cut surfaces. Being once deposited on the immersed article, they form with it a homogeneous whole, and they now act negatively on the copper still remaining in the solution, and again metallic copper is precipitated on it. This process will and must continue until the space between the pieces of metal is filled with galvanically precipitated copper, as is proved by experience; for the space between the opposite cut surfaces becomes smaller and smaller, by the deposit on them of the precipitated copper, and when the deposited particles of metal finally come in contact, the former intervening space is completely filled with copper.

As regards the solidity (the degree of cohesion) of the galvanic soldering, it is the same as that of the galvanically precipitated copper, or in general, that of the precipitated metal; moreover, that the cohesion of the precipitated metal is and must be influenced in proportion to the vigor of the galvanic action is self evident, and precisely the same phenomenon will take place in this case, as has been witnessed in galvano-plastic operations.

In the foregoing experiments the simple or single bladder (diaphragm) apparatus was made use of, although, as far as I know up to this time, any constant element has been employed; but since, by the application of the simple bladder apparatus, the same results have been obtained as by the application of the hydro-electric constant elements, it is a further confirmation of the practical applicability of the galvanic soldering.

M. Philipp states that when a ring, open at one place, is to be galvanically gilt, no deposit takes place at the ends, but that it is thicker, in proportion to its distance from its ends. I have repeated these experiments with bronze rings, (of copper and brass,) and found that the rings were all over completely and uniformly gilt and silvered, and consequently on the opposite ends of the cut portions, which, agreeably to the theory, could not be otherwise.—*Verhandlungen des Vereins zur beförderung des Gewerbfleisees in Preussen, Juli und August,* 1849.

For the Journal of the Franklin Institute.

On the Solar Magnetic Engine. *By* Wm. W. Hubbell, Esq.

To the Committee on Publications of the Franklin Institute.

Gentlemen,—I send to you for publication, an addition to my specification of the "Solar Magnetic Engine," not included in the copy published in the number for August. Accompanying this, is a statement of deductions made by me, from phenomena exhibited by the engine and previously known astronomical truths.

Addition to Specification.

When only two planetary magnets, opposite each other, are used, they may be permanent magnets; and the solar magnet must then change its poles as they arrive at the points of aphelion and perihelion.

In order to equalize the magnetic density as near as possible, between the repelling planetary magnets and the solar magnet, when all are electro-magnets, the batteries which charge them should be connected, positive with positive, negative with negative.

Another mode of applying the solar magnetic principle to use, by which the planetary magnets are made to imitate the action of the comets: that is, to move around different solar centres, is to take several solar magnets, like the one fig. 1st and 2d, (Plate I.,) and place two, three, four, or more, near to, and within, the circuit of the planetary magnets; the poles of the successive solar magnets being on the one side or end positive, the succeeding one negative, and so on alternating successively, and the other side *vice versâ;* in this way the planetary magnets must change poles as they respectively arrive at the different solar magnets.

A similar series of solar magnets may also be set outside of the planetary circuit, and act on the same mode; and the number of series of planetary magnets, and solar magnets, may be increased in this manner to any extent constituting a single engine,—observing that the solar magnets of different poles should never be placed within each other's influence, rather letting the attractive power predominate in the planetary magnets in this case; they representing the principle of comets moving about different solar centres, in which latter there should exist sufficient magnetism for neutralization, as the former respectively pass the points of aphelion without the solar influences conflicting with each other.

Deductions from Experiments.

On surrounding a solar magnet of six inches diameter, by eighteen equidistant planetary magnets, I found that by charging the solar magnet with magnetism, and leaving the planetary magnets or bodies uncharged by the batteries, the solar magnet would polarize them at the clear distance of one inch, (a greater distance I did not try.) This fact convinced me that magnetism diverged from the entire circumference of a solar magnet, similar to the radiation of light from the sun, or any body of light. It is also a known fact that the rays of the sun will, in a few minutes, cause a magnet to be more powerful than it will be when kept for a considerable length of time in the dark, showing that the sun-light is instrumental in the production of magnetism. These facts, together with almost universally known astronomical truths that will be recognized in what I am about to state, lead me to the following superstructure of material law, accounting for the variations and intensity of the magnetic needle; of all which I have no doubt.

In analogy to the solar magnet's polarizing its planetary bodies when not polarized by a battery, I suppose the sun or solar centre to polarize its planets by means of its divergent rays of light; that these rays of light, like the fluid of the solar magnet, diverge strongest at right angles from its axis; that the polar axis of the planets, or focus line of their poles, is always (about) parallel with the solar axis; that the attraction and repulsion existing between the sun and his planets, causing them to approach and recede, and revolve around him, are brought about by the alternate approximation of their poles, owing to the respective oscillating movement of the planets; by means of which, with the earth, (as we say,) the sun passes back and forth between the tropics;—this approximation in the solar engine is produced by changing the planetary poles at the points of aphelion and perihelion by means of the galvanic battery, being another mode of producing alternate approximation of the planetary poles.

My theory, or superstructure of material law, is this: That the sun by means of his rays of light polarizes the planets; and the earth being one of those planets, has, as it rotates on its axis, generated by the light of the sun acting on it, a belt or current of electricity strongest between the tropics, over the torrid zone, which polarizes the extreme parts of the earth, to wit: the north and south poles. Now as the earth oscillates, and the axis or focus line of the poles must be parallel with the axis of the sun, it is evident that the focus of the poles and the axis of the earth can only be coincident when the sun is, as we say, on the equatorial line of the earth, and that at all other times, the focus of the poles must be moving in an approaching or receding spiral circuit about the axis of the earth; this precise conformity of parallelism of polar focus of the earth with the axis of the sun, would also be governed or influenced by the residuary or permanent magnetism of the earth, from which the attraction and repulsion must ensue in the alternate approximations of the poles to the sun; this would influence the degree of variation of the focus of the poles; but nevertheless true it is, and in accordance with other astronomical truths, that the sun by means of his light polarizes his planets, and that the focus of the poles can only be coincident with their respective axis when he is opposite, or is passing the equatorial line; and that at all other times the focus of the poles is in a spiral circuit, either approaching, or receding from, the axis of rotation of the planets respectively; and as respects the earth, the magnetic needle at sea and elsewhere varies, always pointing to the focus of the poles, governed by that focus, and varying about the axis of the earth's rotation as it varies. Again, as the sun by his light polarizes the planets, and the earth varies in distance from the sun as it traverses its annular orbit, it follows necessarily that the intensity of the poles must change with the change of distance, and that the polarization is strongest when the earth is at its aphelion, and least when at its perihelion. This affects the intensity of the magnetic needle, and also another fact affecting it is, the varying distance of the polar focus, as it moves in its spiral circuit about the axis of the earth.

There is no law or demonstration that I can find to controvert this superstructure of natural law; the known variations of course and intensity of the magnetic needle, or compass itself, go to confirm it.

Philadelphia, August 10th, 1850.

Description of a Powerful Magnet.[*]

Mr. Faraday produced (at a meeting of the Royal Institution) a magnet of remarkable power, to which he invited attention. This magnet was made by Mr. Elias, of Haarlem, and presented to Mr. Faraday by Mr. Logeman, of that city. It weighs 0·98 lb., and lifts 26 lbs., and its power is not diminished on the keeper being forced abruptly from the poles, even though this be done many times in succession. Mr. Faraday reminded the meeting of Haecker's formula, which fixes the greatest sustaining power of the best artificial steel magnets at $10{\cdot}33\ N\,\frac{2}{3}$ (N being the weight of the magnet); and he stated that this magnet has twice the power expressed by that formula, and that even when a disk of letter paper is interposed between the poles and the keeper, it will sustain the weight indicated by this formula.

Mr. Faraday mentioned that the small horse-shoe magnet belonging to the Royal Institution weighs 7 lbs. 14½ oz., and lifts from 40 to 41 lbs. (*i. e.*, nearly $10{\cdot}33\ N\,\frac{2}{3}$). He concluded by noticing that this magnet of Mr. Elias would support its own weight at a single pole; and in this property it resembles the cylindrical bar magnets now made in the electro-magnetic helix, and used in the magnetical observatories. He suggested that this horse-shoe magnet of Mr. Elias might probably be charged by a similar process. These magnets are manufactured in Haarlem at a cheap rate, even when possessing great power.—*Proc. Roy. Inst.*

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[*] From the London Athenæum, for May, 1850.

For the Journal of the Franklin Institute.

Vertical Tubular Boilers.

The success attending the use of this form of boiler in the steamers "Atlantic" and "Pacific," running from New York to Liverpool, and the "Osprey," from this port to Charleston, has called the attention of engineers particularly to the subject; and although, for three years past, boilers of this kind have been gradually coming into use, still it was not until the success of the steamers above named that entire confidence was placed in them for marine purposes. The origin of that which is called new is at all times a matter of interest, and having examined a few works on the subject, I offer some remarks, showing the progress made by the invention since 1825. On reference to *Galloway's History of the Steam Engine*, published in 1831, at page 387 we find the following:—

Patent Steam Generating Apparatus, by Joseph Eve, of London, 1825.

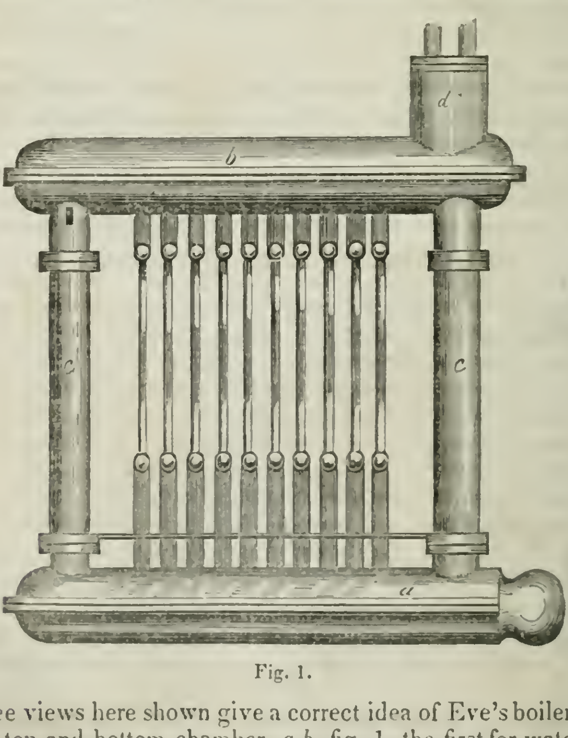

Fig. 1.

The three views here shown give a correct idea of Eve's boiler. It consisted of a top and bottom chamber, *a b*, fig. 1, the first for water, and the latter for water and steam. These chambers were connected together at their ends by the vertical pipes *c c*, and between these were ranges of small vertical tubes, being 10 in width and depth, (100 in all;) the connexion between them is readily seen by the drawing. The small tubes were from 1 to 2 inches diameter, and were slightly bent, (figs. 2 and 3,) to prevent injury from expansion. The grate was directly below the small tubes, and the two large vertical tubes *c c*, and the horizontal chambers *a b*, are imbedded in mason-work, and the small tubes only exposed to the heat of the fire; therefore no steam will be formed in the former, (*a b c c*,) while the action of the fire will cause the steam and water to ascend rapidly through the small tubes into the steam receiver *b*, while the water therein, being heavier than the water combined with the steam in the small tubes, will descend through the pipes *c c* into the lower chamber *a*, thereby causing a continual circulation through all the tubes. The steam will, of course, accumulate at the top, and pass off through the dome *d* to the steam pipe. Such is Mr. Eve's description of his invention in 1825.

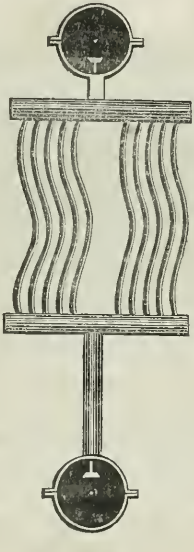
Fig. 2.

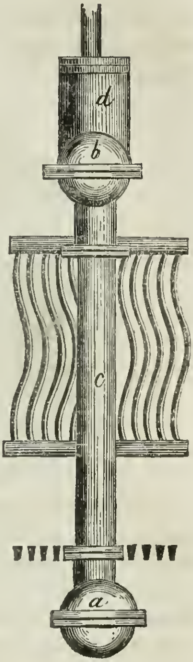

Fig. 3.

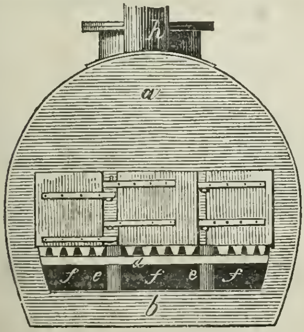

Fig. 4.

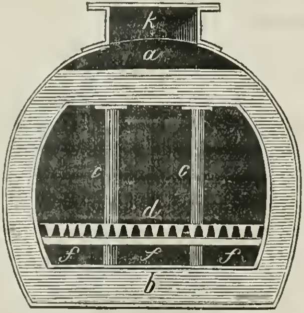

Fig. 5.

On turning to page 404 of the same work, we find the account of a patent steam boiler by Paul Steenstrup, of London, 1828, which is shown by figs. 4, 5, and 6.

Fig. 4 is an end elevation of the boiler, fig. 5 a transverse vertical section, and fig. 6 a longitudinal vertical section, the same letters of reference designating similar parts in each. *a* is the upper division or steam chamber; *b* the lower chamber, connected with the upper by the side chambers and the vertical tubes *c c c*, as shown in the sections; *d* represents the fire bars on which the fuel is laid; *e* the bridge; *f* the ash-pit; *g* the chimney, which is likewise surrounded with water to economize the heat; *h* is the steam pipe; *k* the man-hole.

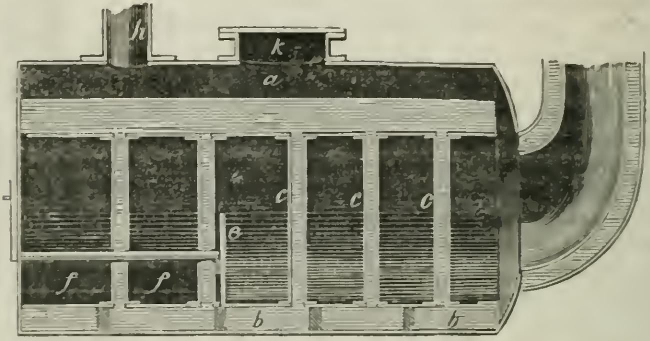

Fig. 6.

Such is the patentee's description of the parts. He then states that this boiler may be adapted to burn either coke, coal, or wood, by merely shifting the bridge back or forward; also that the tubes *c*, which pass through and between the fire bars, will acquire a higher degree of temperature than those near the chimney, and thereby cause an ascending and descending current, which is favorable to the generation of steam. Such is Steenstrup's boiler, and its approximation to some of the vertical tubular boilers of the present time will readily be seen.

The next in time is the boiler of Dr. Nott, of New York, designed by him for the steamer "Novelty," running on the Hudson river in 1830. This boiler is not as good as the two preceding, and is only introduced as belonging to this class of boilers.

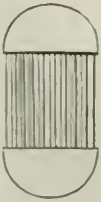

Fig. 7.

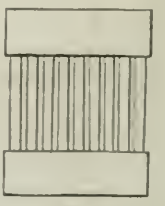

Fig. 8.

Fig. 7 is an end elevation, and fig. 8 a side elevation. The boiler consists of an upper and lower chamber, connected together by small vertical tubes; the heat passes between these tubes, and will cause the rapid generation of steam, but as there are no side *chambers*, *legs*, or *pipes*, to conduct the water down to the bottom chamber, and thus keep up the circulation, the application of intense heat to the tubes may expel the water from them. This is a very objectionable feature, and no doubt prevented their use even on land; for boats they were peculiarly unfit from the large amount of brickwork necessary to confine the fire.

Next in order comes the boiler built about 1835, by Thos. Holloway, of Philadelphia, and at present in use on board the steamer "Camden," now towing on the Delaware. This boiler differs from those which have preceded it, in having the vertical tubes and water sides above the furnace.

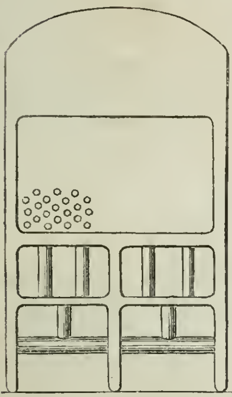

Fig. 9.

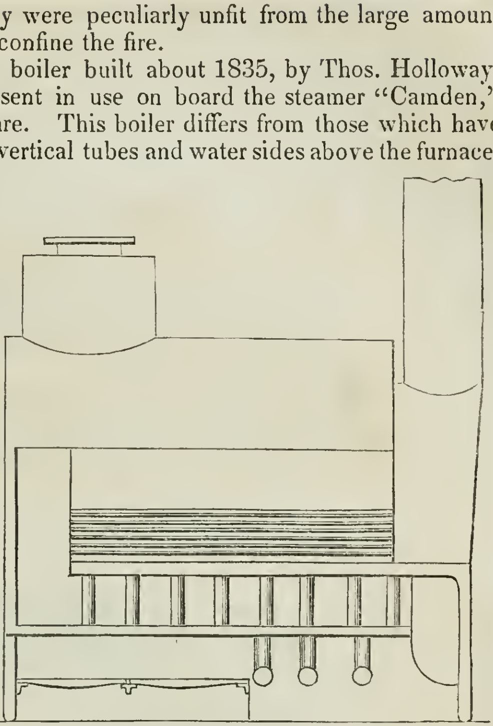

Fig. 10.

Fig. 9 shows an end section, and fig. 10 a longitudinal section. The horizontal tubes, a part of which are shown above the vertical tubes in the boiler, were not originally there, but have been since added. This boiler gives great satisfaction, and has been long used. For several years after the building of this boiler no progress appears to have been made, although entire success with the boiler of Steenstrup or Holloway could easily have been obtained by increasing the number of tubes, a deficiency of fire surface being a common error of that time.

On reference to Vol. xviii., 2d series, 1842, of the *London Repertory of Patent Inventions*, at page 134 we find the specification of a patent granted to John Hall, Dec. 9th, 1841.

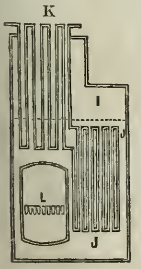

Fig. 12.

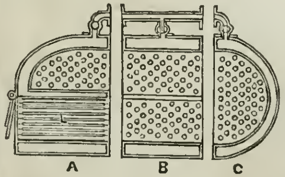

Fig. 11.

The peculiar feature of Mr. Hall's boiler is not vertical tubes and water spaces, *but the making the boiler in three parts*, so arranged that it might be easily taken apart and put together again. The two figures here shown are sufficient to give an idea of Mr. Hall's patent. Fig. 11 is a plan in section, and fig. 12 is a cross section through the furnace; the entire heating surface beyond the furnace is composed of vertical tubes and water spaces.

Mr. Hall says the part A consists of a furnace L, chimney K, the water space J, the steam chest or space I; the parts B and C of the boiler simply consist of water spaces and tubular connexions between the upper and lower water spaces, so as to produce a circulation of the water and to offer an extended surface to be heated. On reference to fig. 11, it will be seen that Mr. Hall used a vertical diaphragm plate of brick, by which the heat was caused to pass between the tubes on one side of the boiler, and return around the diaphragm between the tubes on the opposite side.

In the use of vertical tubes and water spaces, as well as the placing of the tubes in the side flue, Mr. Hall saw nothing new in 1841, and made no claim on that account, but simply making his boiler in sections, that he might take it apart.

In the 2d Vol., 3d series, of the same work, published in 1843, at page 195 we find the following description of a boiler patented January 19th, 1843, by the Earl of Dundonald, a longitudinal section of which is here shown.

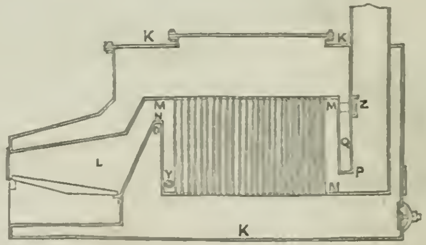

Fig. 13.

The Earl says, "This figure shows a section of apparatus for generating steam for steam engines, constructed according to this part of my invention, and the apparatus is composed partly of tubes or hollow surfaces, the interior of which are open to the water spaces of the boiler, with which the tubes are combined. Such boiler or outer vessel may be varied in shape so long as there be a chamber as hereafter described, between the furnace and fire place and the chimney. K K is a steam boiler, which may be of a square or cylindrical section, or other convenient figure; L is the fire place, M M M M is a rectangular chamber, there being a number of tubes or hollow surfaces in an upright position, through which the water flows in consequence of the water therein becoming hotter than other parts of the boiler. The heat of the fire passes into the chamber M at N, over the bridge O, at the end of the furnace or fire place; and the passage P, from the chamber M into the flue or chimney, is situated as low as possible, in order that the greater heat of the vapors may be retained in the chamber M M, for it will readily be understood that the more highly heated vapors or products of combustion will occupy the upper part of the chamber M M, and the draft into the chimney will only carry off the cooler parts of the vapors, the more highly heated being comparatively in a quiescent state, at the upper part of the chamber M; and it is the peculiar arrangement of the chamber M within a steam boiler, when containing tubes or hollow surfaces, and combined with the outlet P into the chimney, so as to leave a considerable space above it, (for the more highly heated vapors to be retained in the chamber M,) which constitutes the peculiar character of my invention. Z is an opening into the chimney at the upper part of the chamber M M, to facilitate the getting up a draft when first lighting a fire, it being closed at all other times; Y is a steam pipe in connexion with the upper part of the boiler, having a stop cock; this pipe is drilled with many small holes in the direction towards the chimney, by which numerous jets of steam can be projected amongst the tubes, in order to sweep away the dust and ashes when required. I would remark that it is not necessary to have the tubes in an upright position."

Such is the Earl of Dundonald's account of his invention. This boiler is superior to all that have preceded it, and is *identical* with those now in use on board the steamer "Osprey," with the exception that her boilers have not the opening Z, or the steam pipe Y, both of which would be an improvement. The boilers of the "Atlantic" and "Pacific" differ from the above in having two furnaces, one above the other.

In December, 1845, James Montgomery, of Tennessee, took out a patent for a vertical tubular boiler, which is here shown.

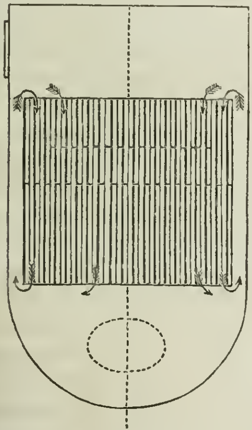

Fig. 14.

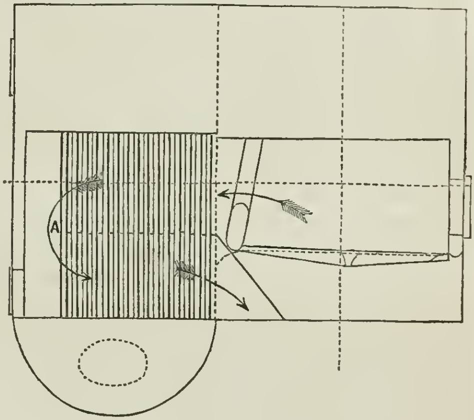

Fig. 15.

His claim is the arranging the fire chamber or furnace of a tubular boiler at the side, so that the heat shall act on the upper half of the tubes, in combination with a diaphragm, or partition, and flue, to carry off the flame, heated air, &c., to act on the lower half of the tubes after acting on the upper half as described.

He also claims the making of the bottom of the boiler of a conical or dished form, with the mud or blow-off valve in the lowest part of the concavity, in combination with the vertical tubes communicating with the bottom, in the manner herein described, to permit the deposit of the sediment, there being a water space surrounding them, (the tubes,) to induce circulation of the water up the tubes and down the surrounding space, to wash the sediment towards the mud or blow-off valve, as herein described.

From the drawing and specification the boiler will readily be understood. Its distinguishing feature is the use of the horizontal diaphragm, which, being placed about midway in the tubes, causes the fire to act as stated. Several of these boilers have been used in steam vessels of moderate size, and for stationary engines; they have given much satisfaction, causing a considerable saving of fuel where they have been used in the place of other boilers. *Properly* constructed, this is a very good boiler, but it has no advantages over the boiler of Dundonald, and I think the diaphragm plate was introduced to correct an imaginary evil, as, in Dundonald's boiler, the lower end of the tubes can never be overheated.

Previous to this time there had existed much prejudice against tubular boilers of any kind for marine purposes, but the success attending the introduction of horizontal and vertical tubes in England, and the boiler of Montgomery in this country, called the attention of those interested in marine navigation to them; and when the steamers "Atlantic" and "Pacific" were begun under the direction of Mr. E. K. Collins, of New York, he caused a large number of experiments to be made with vertical tubular boilers for use in salt water. The performance of the steamboat "Jonas C. Heartt," with Montgomery's boiler, was carefully noted for several days, being equal in time to a trip to Europe.

It being satisfactorily ascertained that the tubes would not choke up, but, on the contrary, would keep perfectly free from scale, Mr. Collins concluded to adopt some form of vertical tubular boiler; but as the form patented by Montgomery was objectionable, from the necessity of returning the heat below the boiler, to unite all in one common chimney, thereby making a flue arrangement not at all satisfactory, he determined to test the use of vertical tubular boilers without the diaphragm plate, being, in fact, the boiler of Dundonald. After a series of experiment, proving that there was no objection, the boilers of the "Atlantic" and "Pacific" were designed by his Chief Engineer, John Faron, Jr., drawings of which are shown on the next page. (Figs. 16 and 17.)

The only difference between these boilers and those of Dundonald is in the furnaces, which are here double, one being above the other, caused by the necessity of obtaining more grate surface than could be obtained with one range of furnaces, the objection that had been urged against allowing the heat to act against the whole length of the tube having, by experiment, been found to be without cause. It is not necessary to say that these boilers, so far at least, are perfectly successful; the short passages made by these ships attest the fact. At or about the time these boilers were designed, Mr. Montgomery surrendered his patent, and obtained a re-issue, dated August 15th, 1848. He claims as follows:—

"1st, What I claim as my invention, and desire to secure by letters patent, is the employment of vertical, or nearly vertical water tubes for steam boilers or generators, that open into water chambers at top and bottom, which water chambers are connected together by a surrounding jacket or water space, made singly or in sections, to admit of the free circulation of the water, which, rising in the tubes by the effect of the heat, will descend in the surrounding jacket or external water space or spaces, and thus, by this circulation, carry off the heat from the tubes and prevent them from overheating, as described, when this is combined with the fire chamber, placed at the side of the boiler and outside of the series of tubes, substantially as described, whereby the tubes are prevented from being

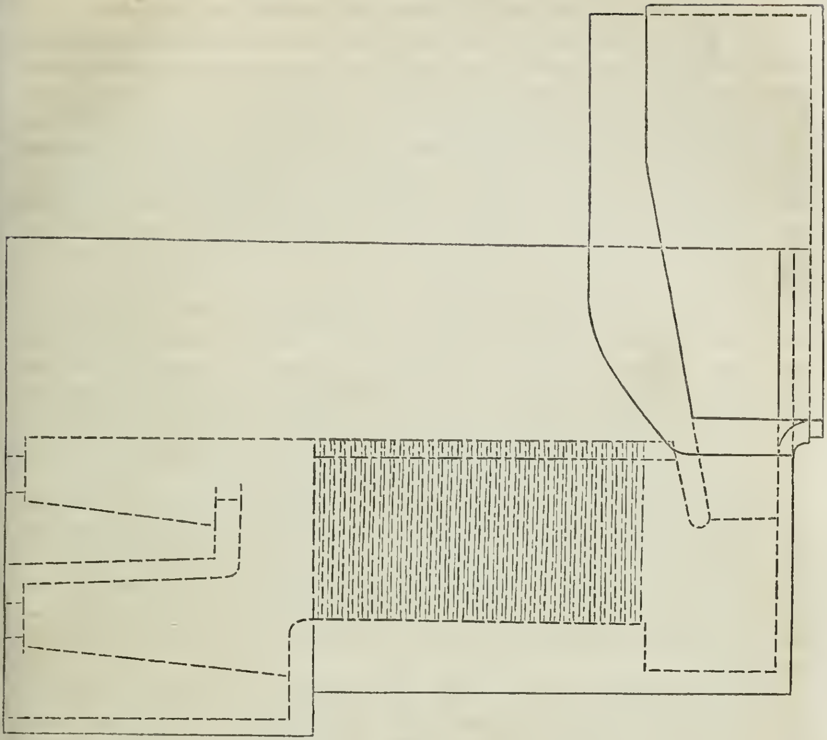

Fig. 16.

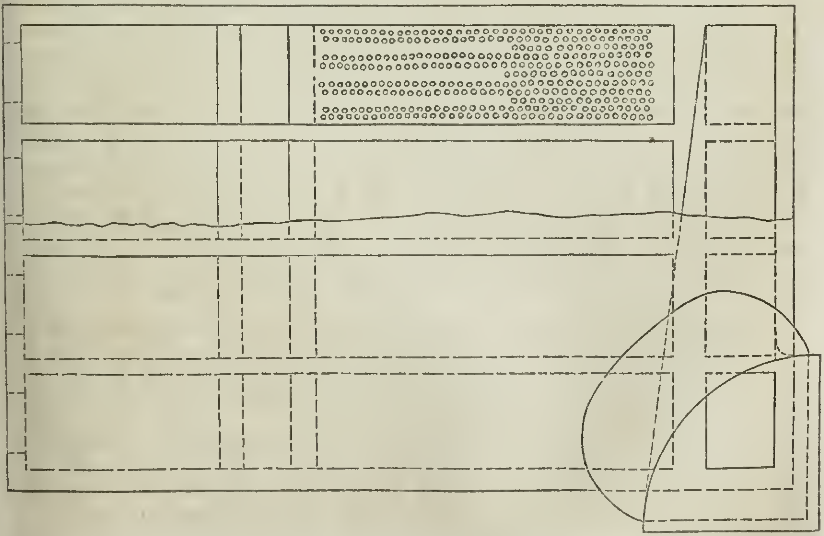

Fig. 17.

overheated and unequally expanded to an injurious extent, and the water kept cooler in the jackets than in the series of tubes, as described.

"2d, I also claim as my invention, in combination with vertical, or nearly vertical, tubes and surrounding water space or spaces, the employment of a fire chamber outside the series of tubes, and so arranged and located, substantially as described, as to apply the most intense heat at their upper ends and the reduced heat towards their lower ends, substantially as herein described, whereby a greater circulation and evaporation is obtained with a given amount of fuel than by any other plan known to me, thereby not only economizing fuel, but effectually preventing the incrustation of the tubes by the deposit of mineral and other solid matter, as described.

"3d, I also claim as my invention, the employment of a diaphragm or partition in the flue space between the series of tubes surrounded by the water space or spaces, and in combination therewith, to divide the same into two parts, that the products of combustion, after passing around the upper ends of the tubes, may pass around their lower ends, substantially as described, and thus more effectually expose the upper end of the tubes to a more intense heat than the lower, as described.

"4th, And I also claim the making of the bottom of the boiler of a conical or dished form, with a wind or blow-off valve in the lowest part of the concavity, in combination with the vertical tubes, communicating with the bottom, in the manner herein described, to permit the deposit of the sediment, there being a water space surrounding them to induce circulation of the water up the tubes toward the wind or blow-off valve, as herein described."

The claims made in this re-issue, and allowed by the examiners at the Patent Office, are in number four. The first claim is for vertical tubes, in connextion with a top and bottom chamber, and with side water spaces, made singly or in sections; this covers the boilers of Steenstrup, Hall, and Dundonald. The second claim is for so arranging the furnace outside the tubes that the greatest heat shall be applied at their upper end, and the reduced heat at their lower ends; this claim and method of arrangement appears to be the same as is minutely described by Dundonald in his patent. The third claim embodies the first part of the original patent granted to him, viz., the use of the diaphragm plate midway in the tubes, as shown in his drawing. The fourth claim is for making the bottom of the boiler conical or dished, in connexion with vertical tubes, etc.; this is also a part of Dundonald's patent, for he distinctly states that his boiler may be made cylindrical if desired, which of course gives the dished bottom.

From what has been stated, it will be seen that the vertical tubular boiler has been nearly 20 years in reaching its present position, beginning with the patent of Eve, in 1825, and ending in 1843, with that of Dundonald. I say ending *there*, for I consider that his boiler has all the elements of success. The boiler of Montgomery, as patented in 1845, although equally as effective if properly arranged, has no advantages as regards economy of fuel, and is simply a modification of the vertical tubular boilers that preceded it, although no doubt patented without the knowledge of their existence. B.

For the Journal of the Franklin Institute.

The Discovery of the Cause of the Felting Power. *By* P. A. Browne, LL. D.

"Nulli negabimus, nulli differemus Justitiam."—Magna Charta.

In the 6th Vol. of the *Ann. de Chem., p.* 300, published in Paris in 1790, is an article from the pen of M. Monge, entitled "Observations sur la mechanisme du feûtrage," in which he explains the operation of felting and the effect of fulling, by *the external conformation of the wool and hair of animals.* The following are the chief points of his observations:—

1st, Nothing, he says, can be discovered by means of the microscope, in the filaments of wool or hair, yet the surfaces are not smooth; they must be formed either of small laminæ slanting towards the point, like the scales of a fish, or more probably of zones placed one upon the other, as in horns, &c.

2d, He notices the different *feelings* experienced when a hair is drawn through the fingers in different directions. And he concludes that, as a hair meets with more resistance when sliding from its point to its root than in the opposite direction, that these scales or zones are the cause.

The author of the essay then remarks that this structure is the principal cause of the felting process. "The pressure (he says) brings the filaments of the wool nearer to each other, and multiplies the points of contact; the agitation gives each fibre a progressive motion in the direction of its root, by means of which they entangle, the laminæ of each filament taking hold of those of the opposite ones, and the whole is retained in close contexture," &c. He adds that "it is necessary that the filaments should not be straight, like needles, for that would induce them to continue the motion without change of direction." This he gives as the reason why the fur of beavers, hares, and rabbits cannot be felted, without rubbing them with a liquid, which, acting on one side of the hairs, changes their directions, &c.

This is probably the first enunciation, in clear and decided terms, of the existence of the *scales* upon pile, and their connexion with the processes of *felting* and *fulling;* but it must be acknowledged that one of the facts upon which the theory was founded had been previously noticed by Fourcroy.

In *Nicholson's Dictionary of Chemistry*, (the 4to edition, published in 1795,) Vol. ii, p. 1061, this article of M. Monge is noticed, and its claims to originality are unimpeached. In truth, no one felt disposed to dispute it, for no one seemed to consider it worthy of confidence. Dr. Young (in his *Natural Philosophy*, Vol. i, p. 186) had attributed felting to *the attraction of cohesion*, and Mr. Luccock had endorsed this opinion. "Mr. Monge (says the Doctor) thinks that the hairs are united by projecting serrations or filaments; but this supposition is not necessary in explaining the *adhesion* of felts, which may be deduced from the *force of friction alone.*" "The particles of thread (says Luccock) are brought in contact, and cohere exactly upon the principle of the leaden balls exhibited to illustrate the attractive power of bodies." Mr. Livingston, (whose book was published in 1799, under the authority of the Senate of New York,) was a gentlemen not only of considerable experience in the growing and manufacture of wool, but he had, during his foreign mission, collected much valuable information upon those subjects; yet he appears to be entirely unconscious of this cause of the felting and fulling property. In page 155 he says, "common wool can hardly be too much carded, merino may; the first gains by being broke [broken] to a certain degree, the last is injured. The object of fulling (he adds) *is to unite the* ENDS *of the wool so as to raise the nap*, &c."

We are therefore justified in the inference, that this theory of Mr. Monge had, at that period, (1799,) taken as little hold of the public mind in Europe, as it had in this country; the seed had been dropped, but it lay dormant.

The celebrated anatomist and physiologist, Bichat, composed his *Anatomie General*, &c., probably about the year 1800, for he died in 1802, and it was not published until about 1804 or 5. In *it* we find this passage:

"Several modern authors say that there may be detached from the exterior envelope of hair a species of scales, which are formed like little branches. You do not perceive their prolongations, nevertheless experience teaches, (as Fourcroy has observed,) that in rubbing a hair between the fingers it moves always like a beard of grain-head, in the direction from base to point, which appears to prove the existence of these *insensible* prolongations, which play an essential part in the adherence of hairs to one another, an adherence from which, when they remain long entangled, as in protracted diseases, they cannot be separated but with great difficulty."—*Bichat's Anat. Gen.*, *Vol.* II, *p.* 787, *of the new ed. of* 1818.

The first merino sheep brought to this country was in 1801, and the gentleman who caused him to be brought was Mr. Delessert, of Paris. In 1809, Mr. Livingston wrote his essay on sheep, before alluded to, which was published by the Legislature of his State. This work attracted much attention, and merino sheep were soon imported, and breeds of our own improved to a very considerable degree.

During the war of 1812,* many patriotic and scientific American gentlemen engaged in the manufacture of woolen goods, and among the rest Mr. Thomas Gilpin, then of Brandywine, Delaware, now of this city; and he assures us that it was often the topic of conversation among these manufacturers, that wool depended for its felting and fulling power upon *certain rugosities of the fibres*, (cortex,) which they called the "*beard.*"

The French society for encouragement of national industry having offered a premium of 600 francs for the best essay upon felting wool for hats, on the 8th December, 1828, the committee reported upon one of a Mr. Felissent, in which it was stated that the fibres of the wool of Denmark, from their roots to within one-third of their length, are covered with *scales*, &c.; that those of the lambs of Sologne extend the whole length; and that it is by the root that wool works (chemine) in the operation of felting, so that the felt ought to be more compact, as the scales, *which hinder the retrograde movement*, occupy the greater space upon the fibres.

The committee, in awarding a gold medal, remark that "the essayist has adopted the ingenious explanation of Mr. Monge of the mechanism of felting."

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* "The American war (says Dr. Ure) gave a disastrous interruption to our old staple manufactures, and caused the price of wool to fall, towards its close, lower than ever it had been when money was more valuable.

Several inferences may be drawn from the above paper, as, 1st, That the existence of the *scales* upon the fibres of hair and wool still depended upon proofs founded upon the sense of *touch*,—no one had yet *seen* them. 2d, That Mr. Felissent was indebted to Mr. Monge for the chief information for which he received the gold medal. And 3d, That, relying upon the theory of Mr. Monge in regard to the felting fibres working their way into the mass *root foremost*, he had erroneously supposed that the only use of the scales was to prevent their retrograde movement.

After this, the whole subject seems to have slumbered again for nearly seven years. At length, viz., in 1835, Mr. Youatt submitted the fibres of merino wool to the microscope, and *saw the scales*.

Dr. Ure, in his *Dictionary of the Arts*, under title Felting, says "the different fibres get interlaced by their ends pursuing ever tortuous paths, their vern*i*cular[*] motion being always, however, root foremost.

This work, it is true, was published in 1839, but as it is a volume of 1334 pages, and its compilation evinces great labor, it was probably commenced *before* 1835. We think that if its learned author had been acquainted with the real cause of the felting property, or even had known of Mr. Youatt's discovery, he never would have given his readers the above description of the art. Under the title Wool, which is, of course, near the end of the same book, and was probably composed in 1838, the Doctor says, "Two years ago I made a series of observations on wool, &c.; their structure under the microscope shews, at intervals of $\frac{1}{300}$ of an inch, a series of serrated rings, imbricated towards each other, like the joints of an equisetum, or rather like the scaly zones of a serpent's skin; (see *Philos. of Manuf., p.* 91, *fig.* 11 *and* 12.")

Upon turning to the book and page referred to by him, we find drawings and descriptions of the scales, shewing that they had been *seen*, but were still imperfectly understood. In regard to the felting process, the Doctor's opinion was changed, for he says, "the felting property depends upon the *serrated mechanism*, but it is not proportional to its development; the imbrications of the fibres lay hold of each other as clicks do to ratchet teeth, so that when the wool is alternately compressed and relaxed, in mass, they cause an intricate loco-motive among the filaments, urging them onward, until they become compacted into a solid tissue called felt." And, in a subsequent page of the same work, this learned lexicographer remarks that "the felting property of wool is in some measure proportional to its softness, and depends conjointly on the annular and other rugosities (the scales) of the filaments, and on their elasticity. In consequence of this structure, when they are pressed and rolled together they become convoluted and entangled by mutual friction. Heat and moisture favor the flexure and curling of the wool, which are essential to the matted texture. For this purpose only the *curling fibres* are fitted, which continually change their direction in the fulling movements, and thereby *interlace themselves round other fibres*."

We think that it will be apparent to the reader that, although the knowledge of the Doctor, in regard to the cause of felting, was considerably improved since he wrote the first article, yet that it had not attained that perfection in the theory of this art of which his vigorous mind was capable.

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[*] Qu. Vern*a*cular, from Vernaculus?

Hitherto the ocular demonstration of the scales had been confined to the coats of the animals inferior to man, but it was soon to be extended to the hair of man.

In the 10th Vol. of the *Edinburgh Journal of Science*, *p.* 327, published in 1839, it was announced that Dr. Goring and Mr. Andrews Prichard had made improvements in the microscope, and the first number of their valuable work on that instrument is noticed; and in subsequent essays of this gentleman these discoveries are detailed.* (See also *Gill's Technological Repository*, *Vol.* IV, *p.* 130.)

In Bostock's *System of Physiology*, (the 4th edition, published in London in 1844,) the author informs us that a hair consists essentially of an external tube and an internal pulp, the tube being delicate and entirely filled with pulp. Although the hair seems to be smooth to the touch, we are informed by Bichat that it actually posseses an imbricated or bristled texture, the processes all pointing in one direction from the root to the tip, analogous to the feather part of a quill; and that it is upon this structure that the operation of felting depends, in which the hairs are mechanically entangled together, and retained in that state by the inequality of their surface.

In a note, this author announces that this peculiarity of structure has lately been confirmed by Dr. Goring; and then, after noticing that the scales were not remarked by Lewwenhook,† nor Fontana, nor Hooke, nor Young, Mr. Bostocks sums up in this remarkable manner: "*I may further remark that I had an opportunity of viewing the hair of various kinds of animals in (under) the microscope of Mr. Bauer, but was unable to detect these appearances.*"

In the 2d Vol. of Gibbs' *Technical Repository*, *p.* 41, the editor says: "We have no knowledge of the kind of microscope employed by Mr. Bauer, but believe that his admirable delineations owe the principal part of their merit entirely to his great skill as a miniature painter." And Dr. Ure (in *Philos. of Manuf.*, *p.* 90) says that "he entertains no doubt of the general skill of Mr. Bauer, but he conceives that the nature of the *medium* in which his objects were placed for inspection has affected their forms very considerably, by refracting or diffracting the light by which they were viewed."

What a lesson is afforded by a perusal of the last few pages, and in what a clear light do they place the obligations which the mass of mankind are under to those few philosophers who devote their whole time and attention to objects of deep thought. Here was a question, "*upon what property or quality in fur and wool depends the simple yet important operations of felting and fulling?*" More than a quarter of a century ago, a gifted French gentleman, probably instigated by an apparently insignificant remark of one of his countrymen, that "a hair rolled between the fingers always progressed from root to point," suggested that the operations of felting and fulling depended upon the structure of the fibres. Let any one read the observations of Mr. Monge, and reflect upon what slender proof he based his theory, compared with the strong reasoning upon which he supported it, and he must come to the conclusion that much credit is due to him.

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* "A hair, (says this gentleman,) viewed upon a dark ground, is seen to be indented with teeth, somewhat resembling those of a coarse rasp, but extremely irregular and rugged. These incline all in one direction, like those of a common file," &c.

† Lewwenhook wrote in 1677, and both he and Hooke used very imperfect microscopes

Five years were allowed to pass before these observations of Mr. Monge attracted notice, and then they were published in a chemical dictionary *without comment*, and were denounced by Dr. Young and Mr. Luccock. Nearly fifteen more years rolled away, and yet so little was thought of this important suggestion, that Mr. Livingston, in his laudable pursuit after everything that could enlighten his countrymen upon his return from Europe, never stumbled upon them.

Bichat, whose young and active mind nothing escaped, gave this cause of felting a few passing remarks in his great work on general anatomy, and all was silent again for another series of years, until Mr. Felissent, allured by the golden prize offered by the French Society of National Industry, appropriated the discovery of Mr. Monge to himself, and bore off the palm!

Up to this time, and for seven more years, no one had *ocular demonstration* of the *scales*, when Mr. Youatt submitted the fibres of the merino sheep to that potent instrument of investigation, "without the aid of which (says Mandel) no one can speak of an object without experiencing a just timidity." With this tardy discovery one might reasonably have expected that the human mind, at least of the man of science, would have been satisfied; yet, strange to tell, an eminent physiologist, in 1844, throws a doubt over the whole subject again, corroborated as it is by the testimony of Dr. Goring, because *he* was unable to detect these appendages *through an imperfect medium, and with little or no experience with the microscope.* We sincerely hope that we have been able, by this brief review, to rescue the names and do credit to the memories of MONGE, BICHET, and YOUATT.

For the Journal of the Franklin Institute.

Iron and Wood Paddles for Marine Steamers.

From an experiment recently made in New York, to test the comparative strength of iron and wood as a material for the paddles of marine steamers, it was found, on subjecting a wooden paddle of 3 inches thick, and an iron one of $\frac{9}{16}$, to the same pressure, the deflexion of the latter was 1 inch to $\frac{2}{16}$ inch in the former. B.

Report upon the Telegraphic Apparatus of M. SIEMENS, *of Berlin, presented to the Academy of Sciences, Paris.*[*]

The telegraph presented by M. Siemens to the Academy is of the kind known as alphabetic telegraphs. Telegraphs of this nature have hitherto been constructed and worked upon the following principle:—The two stations (Paris and Berlin for example) between which communications are required to be made, are united by two insulated wires, which are either stretched across posts, set up at about 50 yards apart, or enclosed in a durable non-conducting material and buried in the ground. If a battery be established at Berlin, having its positive pole in communication with one of these wires, and its negative pole with the other, this is not sufficient to establish a current: for the circuit will be broken at Paris,—the ends of the two wires not being in communication. But if the circuit be closed at Paris, by joining the two wires, or uniting them by any conducting material, the current will be immediately established, and the electric fluid will circulate permanently throughout the wires, as well as through the apparatus by which they are united. In this arrangement, it is stated, in common parlance, that the fluid travels from Berlin to Paris by the wire which communicates with the positive pole of the battery, and returns from Paris to Berlin by the wire which communicates with its negative pole. Care must, however, be taken not to construe literally the received expressions which denote coming, returning, and circulating; for by them it is not meant that the electric fluid really circulates, or that it undergoes a movement of transmission analogous to that of a liquid flowing through a tube, or of gas passing from a gasometer to the burner,—they only mean, that the effect of the electric fluid is felt at the different points of the circuit. When, for instance, sound strikes an echo and rebounds to its starting point, it may be said that it has a backward and forward or a circulating movement; and yet we are well aware that, in reality, the air does not travel from the point where it is disturbed to the surface forming the echo, and thence back to the starting point,—for, instead of traveling, the air merely vibrates, and these vibrations are successively transmitted from one to another with a certain speed; it is, therefore, the action and reaction of the primary impulse which is transmitted, and not the fluid itself; or, in general, the medium which receives the impulse: this must be understood, when speaking of the transmission of the electricity, in the same manner as when speaking of the transmission of sound or of light. The electric current circulates, therefore, from Berlin to Paris, and from Paris to Berlin, on the condition, 1st, that the battery furnishes electricity; 2dly, that the wires are properly insulated; 3dly, that the circuit is complete at all points along the line of communication. If the wires should happen to communicate electrically with each other,—if, for instance, they are united by a fine wire, or by a stream of water, or by damp, or by any other conducting arc, this conducting arc instantly becomes the seat of a derived current, which weakens, in a certain degree, the remaining portion of the circuit.

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[*] From the London Journal of Arts, Sciences, and Manufactures, Vol. xxxvi., 1850.

Theory allows the intensity of a current to be calculated throughout the various portions of its circuit, thus ramified in the most complicated manner, provided all the elements of these ramifications can be arrived at.

Theory has also pointed out a doubly-economical method of establishing a circuit between two distant points, such as Berlin and Paris;—this method consists in dispensing with one of the wires, and using the earth itself as a medium of communication. Let us suppose, for instance, that there is only one wire stretched between these two points, and that at Paris its extremity communicates with the earth by means of a large plate of metal, immersed in the Seine, or even in a well,—and that the negative pole of the battery communicates also with the water of a well, and, consequently, with the waters of the Spree: it will be understood that, immediately the positive pole touches the extremity of the wire, the current will, as above stated, come from Berlin to Paris by the wire; but, instead of returning to Berlin from Paris by another wire, it will return through the waters of the

Seine, the North Sea, the Elbe, and the Spree, and also through such portions of the earth as possess sufficient conductibility to allow of its passage. It is then said that the earth forms a portion of the circuit; and thus a double economy is effected,—first, by avoiding the expense of a second wire; and secondly, inasmuch as the earth, from the great space which it offers to the current, opposes to its progress much less resistance than a second wire.

We will add a few words respecting telegraphic signals:—As the current which passes continuously through a circuit (formed by two wires, or by one wire and the earth) only produces a constant and uniform effect, it is not well adapted for producing the necessarily varied signals which are required for the expression of various ideas. It is therefore requisite to obtain from the current different effects, and to combine them, until a number of signals are obtained, sufficient to reproduce all that is required to be expressed. This is effected in a very simple manner, by interrupting the current and again re-establishing it, and so arranging the apparatus as to cause this alternating action to give rise to a backward and forward movement of greater or less rapidity. For this purpose an electro-magnet is introduced into the circuit, which becomes a magnet during the passage of the current, and loses that property immediately the current is interrupted. So long as it is magnetic it attracts its armature, which is drawn back by a spring when its attractive power ceases;—thus the armature is caused to oscillate or vibrate between the magnet and the spring. These vibrations may be caused to take place with almost inconceivable rapidity, as it is very easy to construct an apparatus capable of producing several hundred in a second; and there seems no reason to doubt that this number might be increased tenfold. It will be seen, however, that there is one condition absolutely necessary for this purpose, viz., a due proportion between the power of the spring and that of the electro-magnet: the power of the latter depends upon various conditions, but more especially upon the intensity of the current.

An alternating motion being obtained, of the required speed and regularity, it is easily converted into rotary motion, whereby a needle may be made to travel round a dial upon which the letters of the alphabet or other conventional signs are marked. To enable the letters to be read, it is sufficient to cause the needle to stop for a very short time (a quarter of a second for instance) opposite any particular letter;—words are thus formed, and have merely to be taken down as fast as the telegraph acts. In this way each single oscillation might be made to correspond to a letter on the dial; it is, however, generally thought more advisable to arrange the apparatus so that one letter should be passed at every double oscillation only: thus, supposing there are thirty signs upon the dial, thirty double oscillations of the armature will be requisite to enable the needle to travel right round the dial. By this means the needle is only stopped for an instant at the end of the double oscillation: that is to say, whilst the armature is under the action of the spring, and not attracted by the magnet.

It now remains to explain the manner in which the operator at Berlin, on transmitting his message, interrupts the current with the required speed and regularity; and how he is enabled, with certainty, to stop the needle at the other station, viz., at Paris, exactly at the required letter. For this purpose he has an *interrupter*, viz., a wheel of, say, 60 centimetres in circumference, and divided into 60 equal parts: these divisions, forming a cylindrical surface on the periphery of the wheel, are alternately of metal and ivory, *i. e.* conductors and non-conductors; and, opposite these non-conductors (thirty in number), thirty signs, employed in the telegraph, are arranged in the same order as on the dial at Paris. The two ends of wire, which are to come in contact to complete the circuit, are made to bear against the periphery of the interrupter,—both ends being upon one of the divisions of the wheel: when they come opposite a metal division, the circuit is complete, and, consequently, the current is in action; but when an ivory division comes under the wires the circuit will be broken, and, consequently, the current will be interrupted. Thus, if the operator turns the wheel by hand one entire revolution, (commencing with an ivory division,) it is certain that the circuit will have been thirty times broken and completed, and that the electro-magnet will have been thirty times converted into an electro-magnet, and thirty times deprived of its power; the armature will have made thirty double oscillations, and the needle will have made an entire revolution round the dial, in the same manner as the interrupter at Berlin. If the two accorded, *i. e.* if they corresponded with the same sign or letter on commencing, they would agree at the conclusion; and nothing can be easier than to cause them to correspond. Each station must be furnished with the two kinds of apparatus above described, viz., the interrupter for transmitting the message, and the dial for receiving it; there is also a third apparatus, called the alarm bell, which is only introduced into the circuit when the correspondence is stopped, but which enables the party desirous of sending a message to signal the party at the other station.

All alphabetical telegraphs constructed previously to M. Siemens' are upon the above principle; and they may be characterized generally, by stating that they are provided with an interrupter worked by hand by the party sending the message, and that, consequently, the party receiving it is obliged to remain passive until his correspondent allows him to speak; and that, although various kinds of apparatus have been employed, the only variations have been in the methods of converting the reciprocating into rotary motion; or in the arrangement of the dial, or the form of the interrupter, or the number of its divisions.

To be Continued.

On the Properties of the Diamond for Cutting Glass, with descriptions of machines invented by the author, in which the Diamond is made to perform perfectly what by manual labor had before been very imperfectly done. *By* MR. ANTOINE CLAUDET.*

The author commenced his paper by a very interesting description of the nature of the diamond, of the form of its natural crystal, and of the mode in which it cuts glass,—quoting a paper on the subject by the late Dr. Wollaston, in the *Philosophical Transactions* for 1816, as well as by a history of the use of glass in windows from the earliest times, when it was used only in ecclesiastical buildings of great splendor, down to its present universal application. He has also, in order the more thoroughly to make apparent the advantage of the use of the diamond, described minutely the very tedious and imperfect methods by which, before its introduction, glass was cut and shaped. The property in question was first found out about the time of Francis I. of France, the well-known anecdote of whom is quoted; and the different tools used from that time to the present for its manual application are detailed and commented on, many of them being exhibited by the author. The first of these was a mere handle, having the diamond firmly inserted into the lower end. But the handle being round, and the diamond, from the form of its crystal, requiring one unvarying direction to be preserved in order to produce a cut, this was found so imperfect that a step was taken by making the end of the handle flat, to preserve the parallelism against the rule. This, from the shape of the bottom in which the stone was set, was called the "plough diamond." In 1814, Shaw, of London, made a great improvement, and brought the instrument to the shape in which it is still used, by making the metallic setting of the diamond movable on a ferrule at the bottom of the handle, thus putting it out of the power of any deviation of the hand from the proper position to affect the direction of the stone. This, perfect as it may seem, is still difficult to use, and requires long practice for expert performance. The two tests by which the workman knows when his tool is "making a cut" are the sound and the feel. A modification of the last-named tool, by the brother of its inventor, was formerly used for those who have but little practice; but it was very little used, and the one shown to the meeting by Mr. Claudet was curious, from being, perhaps, the only one now in existence. A contrivance for cutting circular plates was shown in action.

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* From the London Civil Engineer and Architect's Journal, for June, 1850.

The cause of the invention of the machines, the description of which was the principal object of the paper, was the increased use of glass shades for covering ornaments, the cutting of which, so that they should stand perfectly firm and with an even base, was a most tedious and imperfect operation when done by hand. The manufacture of these shades, which, under the name of "cylinders de verre," had long been carried on in France, was first undertaken in England, at the instance of Mr. Claudet, by Mr. Lucas Chance of Birmingham, who, in the true spirit of enlightened enterprise, notwithstanding the vexatious pressure of the excise laws, now repealed, embarked largely in the manufacture, getting workmen from France, for making both shades and the sheet glass, which had there been for some time made from cylinders. It was now, however, found that some method of cutting the bottom of the shades and cylinders must be adopted surer and less expensive than the manual method, and Mr. Claudet was driven by this necessity to invent his machine.

The principle of the machine, expressed in the fewest words, is this: The shade is firmly fixed between an internal support and a transverse bar above it, in a perfectly upright position, above a horizontal, level, and smooth table, its bottom being a few inches above the table. Upon the table travels a small but heavily-weighted base, moving on castors, having springing from it two upright pillars, one holding the diamond, and the other forming a support opposite to it. The pillar holding the diamond is fixed, but the other is movable, being by a spring kept close to it. The height of the whole is such that, when on the table, the diamond is about an inch above the bottom of the shade. The diamond being introduced inside the shade as it hangs suspended, the pressure of the spring is sufficient to cause it to cut, and it has only to be moved round the shade, the horizontality of the table causing the cut to be perfectly level. This machine was exhibited, and the bottoms of shades cut by it, before the meeting. The shape of the shade, whether oval, round, or square, is unimportant in the use of this machine, but Mr. Claudet has contrived another for the cutting of round shades only, in which the shade is laid horizontally,—an elegant system of adjustments being provided, by which shades of any diameter can be cut by the workman with little risk of error. This machine was also shown in action.—*Proc. Soc. Arts, Lond.*

Exhibition of the Massachusetts Charitable Mechanics' Association.

This Association propose to hold this year their Sixth Exhibition of American Manufactures. It will be held in Boston, and will be opened for visiters on Wednesday, 11th September, but no goods can be entered to compete for a premium, or can be inserted in the catalogue, after Saturday, 7th September.

The high order of excellence which has hitherto marked the exhibitions held under the auspices of this Association, and the good taste and efficiency which has characterized their arrangements, will ensure for them an interesting collection of goods, and we especially invite the attention of our subscribers to their circular. The question of the utility of such exhibitions, both to the manufacturers themselves and to the country at large, may now be considered as entirely settled, and their rapid spread throughout our whole land shews that they are appreciated by those whose interests are concerned in them.

Notwithstanding the temptations held out by the great world competition to be held in London during next year, we hope all our mechanics and producers will recollect that their true interest is best subserved by the maintenance of such institutions at home, and that this country is and must be the principal consumer of its own goods. A comparison of our powers of production with those of European countries, if a fair opportunity for it be granted, must be advantageous to us in many ways,—in none more than in pointing out to us our deficiencies; but the constant exhibition of the products of our own industry to our own people is almost essential to the maintenance of our manufactures, and, by means of them, of our true national independence.

There will be four such exhibitions held during the ensuing fall, in the following order:—

At Boston, commencing on Wednesday, 11th September.
At New York, commencing on Tuesday, 1st October.
At Baltimore, commencing on Monday, 14th October.
At Philadelphia, commencing on Tuesday, 15th October.

We hope that they will all prove successful. Ed.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, August 15th, 1850.

Thomas Fletcher, Vice President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Letters were read from The Royal Geographical Society of London, and from The Massachusetts Charitable Mechanic's Society, Boston, Mass.

Donations were received from The Chemical Society, The Royal Astronomical Society, and The Royal Geographical Society, London; The Royal Irish Academy, Dublin; Hon. A. C. Green and Hon. Joseph R. Chandler, U. S. Congress; Messrs. Little & Brown, Boston, and John C. Trautwine, Esq., Philadelphia.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of receipts and payments for the month of July.

The Board of Managers and the Standing Committees reported their minutes.

The Chairman of the Committee on Exhibitions reported a resolution passed by the Committee, amending the regulations for the government of the Committee, which they asked to be adopted by the Institute, and that authority be given to the Committee to carry the same into effect.

New candidates for membership in the Institute (5) were proposed, and those proposed at the last meeting (2) were elected members of the Institute.

On motion, the resolution proposed by the Committee on Exhibitions was laid on the table for the present.

BIBLIOGRAPHICAL NOTICE.

A Treatise on Plane and Spherical Trigonometry. By WM. CHAUVENET, A. M., *Professor of Mathematics in the United States Naval Academy. Philadelphia,* 1850.

This work is an important addition to our mathematical literature, being the most complete treatise on trigonometry extant in the English language. While it contains everything useful to the mathematician and astronomer, the more elementary portions of the work are easily distinguished by the larger type in which they are printed, and form of themselves a connected treatise adapted to the wants of the young student. Those who wish to pursue the subject to its higher developments cannot fail to appreciate the advantage of having them treated of in connexion with the more fundamental considerations to which they are related.

Treatises on this branch of mathematics are sufficiently numerous to make any addition to their number a work of supererogation, unless it has some distinctive features of excellence. Of these Prof. Chauvenet's book has not a few. Among them we instance the introduction of the Gaussian equations, which are wanting in all the text-books used in our schools; of the finite variations and differentials of triangles; of the solution of the general spherical triangle according to Gauss, and the general development of the sines and cosines of multiple angles in series according to Poinsot. Not the least important feature of the work is the representation of the trigonometrical functions as *ratios*, in contradistinction to the usual method of making them identical with the *lines*. The latter mode of consideration has not only pliability for pure trigonometrical developements, but becomes a positive hindrance to the student when he meets with similar relations in physical science.

The only subject we have missed in Prof. Chauvenet's treatise is the developement in series of the differences in the spherical triangle, in which two sides and the included angle are given, when one of the sides is very small, a case of constant occurrence in geodesy. With this little exception, the book leaves nothing to be desired, and we doubt not will rank among the most classical works on pure mathematics. J. E. H.

The Chemical Tables for the Calculation of Quantitative Analysis of H. Rose. *Re-calculated for the more recent determinations of Atomic Weights, and with other alterations and additions. By* William P. Dexter. *Boston*, 1850.

Mr. Dexter has done the working chemist good service by the publication of an American edition of this work, which, though of small volume, is of great use in facilitating chemical calculations, and has cost the author and his American editor immense labor. In the present state of belief as to atomic weights, it is, we suppose, impossible to please everybody in the selection of the numbers; and we admit that, if Mr. Dexter was to take any one as authority on all questions, he could not do better than follow Berzelius. We admit, too, the prudence of his resolution to adhere to the actual results of experiment. Yet while, as critic, we freely give in our adhesion to his principles, we cannot but think, as chemist, that the evidence of all recent satisfactory determinations of atomic weight has gone to shew the great probability of Prout's law, and to give us cause to hope that we shall all finally recognise in all atomic weights multiples of that of hydrogen. In the mean time, we cannot but commend this valuable and neatly printed work, and recommend it to all working chemists who desire to economize their time, temper, and comfort. Ed.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

OCTOBER, 1850.

CIVIL ENGINEERING.

Extracts from the Report of PROF. ALEX. D. BACHE, *Superintendent of the Coast Survey, showing the Progress of that Work for the year ending November*, 1849.

Continued from page 152.

SECTION VI.—*From the St. Mary's River to St. Joseph's Bay, Coast of Florida, and including the Florida Reefs and Keys.*—(Sketch F.)

No portion of the coast of the United States has stronger claims than this to a speedy and minute survey, whether we regard the dangers to navigation, the amount of commerce which passes by it, or the various localities of the Union interested in the trading vessels. The representations made on this subject from New York have been as strong and as urgent as those from Florida itself, and the lists of wrecks annually presented under authority of the board of underwriters furnish the best evidence of the necessity of the work. In the year 1848, 41 vessels hailing from 20 different ports, and valued with their cargoes at $1,282,000, were wrecked upon this coast; the amount of salvage awarded upon them was $125,800, and the total amount of expenses $200,000.—(Appendix No. 14.)

Were the dangers of this coast made known by accurate charts, the direction and force of currents duly examined, the action of tides and character of winds investigated, the positions for lighthouses, beacons, and buoys suitably determined, and the necessary aids to navigation provided, this loss of property would be much diminished.

In reply to a resolution of the Senate of the United States, the Secretary of the Treasury recommended a special appropriation for the more speedy survey of this part of the coast than could be secured from its proportion of the ordinary appropriation for the survey of the coast of the United States. The amount suggested in my report, transmitted by the Secretary of the Treasury to the Senate, was about sixty thousand dollars per annum. For the discussion of this subject, and the information collected in relation to it, I refer to this report, in Ex. Doc. No. 30, Senate, 30th Congress, 2d session. The amount appropriated for the present fiscal year was thirty thousand dollars, furnishing means for a gradual but not a speedy survey. On a statement to the Treasury Department of the urgency of the case, I was authorized by the present Secretary to proceed at once with the work in anticipation of the fiscal year, and organized two triangulation parties and a hydrographic party to proceed at once to commence the survey. Various circumstances beyond my control, and beyond that of the officers in charge of the parties, prevented the full effect of my plans, but a satisfactory beginning of the work had been already made when the advance of the summer rendered its further prosecution impracticable. The land parties have, with increased force, resumed their operations at the earliest period of the autumn when they could work with safety. The sketch shows the progress of the work made before the summer rendered it necessary to close operations, and the details are given in the following paragraphs under their appropriate heads.

The first object proposed was to connect the survey already executed by Major Hartman Bache, of the topographical engineers, in and near Key West harbor, with the coast survey, and to extend the limits of the hydrography; to furnish the basis of the hydrographic reconnaissance near Key Vacas and the Pine islands, in reference to channels across the reef alleged to exist there, and of Bahia Honda, in reference to its changes. While this hydrographic work was doing, to prepare for the regular operations of the survey by commencing first at Cape Florida, and passing towards Carysfort reef, and subsequently by a base near Cape Sable, and a connexion with the keys and Florida reef, to push the regular survey both eastward to meet the former, and westward towards Key West, following up the land work closely by the hydrography.

While on the coast of Key Biscayne bay, Mr. Gerdes, in accordance with a request from the Secretary of the Treasury, ran a line of levels from the Everglades to the low-water mark on the gulf, following the general direction of the Miami river, from the upper falls to near its entrance into Key Biscayne bay. The general course of the line was ESE., its length 3¾ miles, and the level of the water in the glades was 6 feet 2·5 inches above low tide in the gulf. When the levellings were made, the level of the water in the glades was stated to be lower, and the tide in the gulf higher, than ordinary, and Mr. Gerdes, therefore, placed two permanent bench-marks for future reference. No means were at his disposal for ascertaining the depth of water in the Everglades. The average fall per mile thus ascertained by Mr. Gerdes is nineteen inches and eighty-seven hundredths. The *average fall* of the Ohio and Mississippi, from Pittsburg to the sea is stated at four inches and thirty-four hundredths per mile.

Appendix No. 2.—*Results of the Coast Survey at different periods from* 1807 *to* 1849.

	From 1807 to 1819.	From 1832 to 1844.	From 1844 to 1849.	Totals.
Reconnaissance, area in square miles,	560	18,103	22,544	41,207
Triangulation, do. do.	450	14,483	* 19,309	34,242
Extent of coast line, . .	—	310	405	715
Do. shore line, reckoning bays, sounds, &c	—	3,215	4,211	7,426
Astronomical stations, number of .	3	11	47	61
Magnetic stations do.	—	10	88	98
Vertical angles do.	—	7	34	41
Base lines do.	—	1	4	5
Preliminary base lines do.	2	—	3	5
Topography, area in square miles,	—	6,222	2,755	8,977
Length of shore line, . .	—	6,100	4,055	10,155
Hydrography, area in square miles,	—	† 9,623	‡ 15,910	25,533
Hydrography, number of soundings,	—	808,147	951,002	1,759,149
Gulf stream, number of soundings for temperature, . . .	—	—	1,410	1,410
Gulf stream, fathoms of line, .	—	—	139,747	139,747
Current stations, number of .	—	—	223	223
Tidal stations, do. . .	—	13	60	73
Specimens of bottom, do. .	—	500	4,098	4,598
Total number of manuscript maps, .	—	326	295	‖621
Of these manuscript maps, number prepared in office, being reductions, &c.	—	29	123	152
Original topographical maps, number of	—	160	100	§260
Containing sheets, do.	—	298	131	429
Original charts, do.	—	103	72	¶175
Duplicates, . . .	—	34	—	34
Containing sheets, number of .	—	236	160	396
Records, triangulation bases, &c., number of volumes, . . .	4	95	233	332
Astronomical observations, &c., vols.	1	16	140	157
Computations, geodetic, &c., do.	1	78	138	217
Computations, astronomical, do.	2	4	138	144
Magnetic observations, do.	—	4	37	41
Magnetic computations, do.	—	—	15	15
Geodetic books, duplicates, do.	1	26	128	155
Meteorological books, do.	—	2	7	9
Meteorological books, duplicates, do.	—	—	3	3
Original hydrographical books, soundings and angles, number of vols.	—	179	380	559
Duplicate do., do.	—	27	32	59
Hydrographical books, tidal and current observations, and tidal reductions, vols.	—	8	158	166
Astronomical differences of longitude,	—	—	66	66
Total of records, . .	9	439	1,373	1,928
Engraved plates of maps, number of	—	5	24	29
Engraved plates electrotyped, do.	—	—	8	8
Published maps, do.	—	—	21	21
Printed sheets of maps, do.	—	—	24,249	24,249
Do. do. do. distributed, do.	—	—	7,678	7,678
Do. do. do. sale agents do.	—	—	12,979	12,979
Volumes in the library, . .	—	—	—	655
Instruments, &c., value of . .	—	—	—	$149,513

* In sections III, IV, VIII, and IX, the primary and secondary triangulations are united in general.

† 5000 of off-shore work. ‡ 11,000 of off-shore work. ‖ 11,215 sq. feet of paper.

§ 4056 square feet of paper. ¶ 5891 square feet of paper.

APPENDIX No. 5.—*Report of Professor O. M. Mitchel, of Cincinnati, on the Mechanical Record of Astronomical Observations.*

CINCINNATI, *November* 10, 1849.

SIR: In accordance with your request, I have the honor to present to you the following report on the subject of the mechanical record of astronomical observations.

During the month of October, 1848, while engaged in company with S. C. Walker, Esq., assistant United States coast survey, in observing for difference of longitude between Philadelphia and Cincinnati by the telegraph, it was perceived that in this operation great advantage would be gained, in case the Philadelphia clock could be made to record its beats in the Cincinnati observatory. Mr. Walker gave me to understand that this problem had been discussed by yourself and others, and that a mechanical solution had been proposed by Professor Bond, of the Cambridge observatory, but had not been executed.*

On the afternoon of the 26th October, 1848, the subject was discussed by Mr. Walker and myself, in the presence of several gentlemen, who were then assistants in the Cincinnati observatory, and in the United States coast survey. After closing the conversations, I reflected on the most simple mechanical means by which the desired object might be effected, and on the same evening executed the first rough plan which occurred to me. The pendulum of a common brass clock was connected with one pole of the battery, and at each vibration touched a small wire which was connected with the other pole of the same battery. At every such contact a current passed and operated the recording pin of a Morse's register, giving a dot for every alternate second on the running fillet.

This was the first rude contrivance, and in its application it manifestly interfered with the rate of the clock. In case the spring was reduced to sufficient delicacy to produce no sensible effect on the pendulum, then the contact was not sufficiently firm to give a sure connexion.

Further reflection on the subject that night suggested to me another plan, which was executed on the following morning. This second plan consisted in attaching to the lower part of the pendulum a small wire, which, at each vibration, dipped into a cup of mercury connected with the other pole of the battery. In this case, as in the former, the current passed through the pendulum of the clock. This was, however, by no means necessary to the plan, as the wire could readily be insulated, and the pendulum would then only be used as the moving power.

On presenting this plan to Mr. Walker, he expressed the opinion that any interference with the pendulum would entail uncertainty on the rate of the clock; and hence it would become inapplicable in practice for the ordinary work of an observatory.

At that time the Cincinnati observatory had no astronomical clock, and it was impossible to try the experiment. I was, however, satisfied that in case the pendulum was taxed to either make or break the circuit, this could readily be made absolutely constant, and hence as good a rate could be given to the clock with this permanent fixture as without it. Subsequent experiment has demonstrated the truth of this opinion, as has been shown by Mr. Walker, as well as by my own experiments since the arrival of a new sidereal clock recently presented to the Cincinnati observatory.

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* The drawings had been submitted to me, and approved, and the work was in the course of execution.—A. D. B.

After some difficulty I succeeded in obtaining the privilege of using for a short time a solar clock, the property of one of our citizens, and the evening of the 28th of October, 1848, was fixed upon for an experiment between Philadelphia and Cincinnati for difference of longitude by the new method. The morning of the day proved stormy, and the clock was not removed to the observatory.

Having organized a party for the preliminary surveys of the Ohio and Mississippi railroad on the first of November, I found it necessary to leave the observatory, and my experiments were broken off, and could not be resumed until the close of January, 1849. It was, however, agreed between Mr. Walker and myself that on the arrival of the sidereal clock then ordered, we would resume the experiments and work between Philadelphia and Cincinnati.

A few experiments made before leaving the observatory in October, 1848, on the uniformity with which the Morse fillet could be delivered, showed great irregularity of motion, and convinced me that it would be inapplicable to the requirements of astronomy. One hundred seconds recorded on the fillet were never equal to any other hundred seconds; hence the second spaces were of unequal length, and any fixed scale for their measurement would be impossible.

My present method of recording right ascensions was communicated by letter to you under date of the 5th of February, 1849. The machinery was not finished until some seven or eight weeks after that date, in consequence of my absence from the observatory.

I shall now proceed to describe this machinery, and that subsequently invented for the record of declinations, in as few words as possible.

Any machinery to be useful in the record of right ascensions, must fulfil the following conditions, viz:

1. The record of time and observations must be accurately, distinctly, and perspicuously made.

2. The machinery must be simple, easily adjusted, not liable to the effects of atmospheric changes.

3. The record must be simple, easily read, and condensed within a narrow and convenient compass.

To accomplish the fulfilment of these conditions, I conceived the following mechanical contrivance:

1. A horizontal disk is caused to revolve on a vertical axis with uniform velocity.

2. This disk carries either a metal plate or a paper disk, on which the time and observations are recorded by pens drawn by electro-magnets.

3. The time pen is operated by the sidereal clock, by attaching a delicate cruciform lever to the pendulum by a spider's web. This lever at every alternate second dips into a cup of mercury, forms the connexion, and a second's dot is struck by the time pen on the paper or metallic disk revolving beneath the pen.

4. The pen for recording observations is under the control of the observer at the instrument, who records his observations by simply touching

a key, which, by mercurial connexions, forms the circuit, and operates the observation pen.

5. When the disk performs one revolution, it trips on a railway, and is thrown forward the tenth of an inch by self-acting machinery, when a new circumference of time dots is commenced.

In the use of this machinery we commence by adjusting the disk to revolve once in every sixty seconds. This is usually accomplished in five or six minutes. It is then adjusted to trip between the 59th and 0 second of every minute. This adjustment occupies about three minutes. These being completed, the 0 second of every minute falls in a right line radiating from the centre of the disk. The 2d, 4th, 6th, &c., seconds radiate in right lines in like manner.

Noting on the face of the disk any hour and minute, and second, from the face of the clock, the entire disk presents a perfect circular time scale, as easily read as a table of logarithms, or other tables arranged in horizontal and vertical columns.

The observation dots fall intermediate between the minute circles and second dots, and are struck so as to distinguish them by form from the time dots.

Having closed all the mechanical arrangements for observing in R. A., I introduced a new diaphragm containing 25 wires, arranged in groups of *seven*, by making the *seventh*, the *thirteenth*, and *nineteenth* wires a little longer than the others. As many as *fifty* wires have been used, but for ordinary observing the number has been fixed at twenty-five. The disk has now been in use for several months, and is found to be very controllable and convenient; its adjustments are rapidly made, and the uniformity of its motion is such as to give a record of time far more accurate than any observations can be made.

The time and observation pens are so constructed that they cannot rest upon the disk any sensible time. By making the magnetic connexion for ever so long a time, nothing but a minute round dot can be made.

By this machinery we are enabled to observe with an accuracy in which the actual errors on any one wire struck and recorded are but one-half of the average Greenwich errors on one wire. Hence *one* wire by the new method becomes equal in weight to four Greenwich wires, and a 25-wire new observation is equal to about 15 of the 7-wire observations, as made at Greenwich. This refers to average work as already done at the Cincinnati observatory. Should experience enable us to equal our best work, our errors would be only one-fourth of the Greenwich errors, and the above motion would be greatly increased in favor of the new methods.

We are now able to observe *double stars*, in which the diff. in R. A. exceeds half a second of time with astonishing accuracy. Among other stars we have observed β^1 and β^2 Lyræ, 61 Cygni, and β Cephei.

We find by an examination of the intervals of the wires, as determined by double stars and by single star observations, that our work in double stars is not quite so accurate as that involving only one object; and yet, from observations of the former kind, our mean difference from the mean show a probable error of any one mean diff. of R. A. not to exceed *five thousandths* of one second of time, as deduced from 25-wire observations.

I now proceed to give some account of the mechanical means for recording *differences of declination.*

Soon after my attention was directed to the examination of the subject of a mechanical record of R. A., I conceived a method of recording declinations; but being unwilling to divide my attention, this plan was not executed until the beginning of August, 1849.

I have attached to the axis of the transit or equatorial, by a strong clamp-collar, an arm, which (as now in use) is about 6 feet in length. To this arm such a form is given as to avoid, as far as possible, any sensible flexure from a position out of the vertical. To the upper part of this arm an electro-magnet is fixed, which operates a double lever armed with a steel recording pen. To receive the record, a metallic plate is placed vertically on the face of the transit pier, moving in ways parallel to the circles described by the recording pen. To use this instrument for record, the observer sets for his standard star; the arm is then brought to the vertical and clamped. The instrument is then clamped, and a tangent screw gives to the observer his slow motion for bringing the star to the declination wires. When the star is bisected the observer strikes the key with his finger, the circuit is formed, the electro-magnet brings the pen in contact with the record plate, and, while in contact, the plate descends in its ways, and a zero line is described on the plate, from which all differences of declination are afterwards read. At present we use three declination wires, and there are three zero lines obtained from the standard star. The number may be increased up to *five*, or even *ten*, if desired; and in this way almost any number of declinations may be obtained during one and the same transit. When the difference of declination of one star has been recorded, the plate moves upward about the tenth of an inch, and is ready for the next record.

It will be seen that we are now recording a declination on a circle of nearly *twelve feet in diameter*. This may be increased to *forty* feet, if desirable. The only source of sensible error yet perceived in this method arises from possible flexure. This may readily be ascertained by observing the same stars with the arm vertically *down* and vertically *up*. The first set of differences will be too short, the second will be too long, by the error of flexure. Their difference will be the double error. No sensible value has yet been obtained. The arm, as now used, never leaves the vertical more than 5° of arc, and its form is such as to secure it from sensible flexure absolutely within such limits.

To read the records of R. A. and declination, certain machinery has been constructed. The R. A. is read by a sector composed of two legs, revolving on a pivot, one of which bears an arc divided to read to hundredths of a second of time.

To read the record of declination, the plate is laid on a carriage and leveled by four screws; a movable arc, divided into equal parts, whose values have been absolutely determined and tabulated, is adjusted so that its O coincides with the zero line of the record. It then glides on its ways parallel to and just above the record plate. A micrometer screw and microscope, with a spider's web, reads the fractions of the equal parts into which the arc is divided, with great facility and with great accuracy. In applying this machinery to the purpose of cataloguing, all light is dispensed with, and the wires usually employed are superseded by *occulting bars.* The R. A. is taken by ingress and egress, while the star is bisected by the edge of the horizontal occulting bar for declination.

The system of record is the following:

The observer fixes the width of his zone in proportion to the number of stars in the region under examination. An assistant records on the catalogue the number of the star and its magnitude as called out by the observer. The stars are recorded in R. A. on the disk, and in declination on the sliding plate. The standard stars are readily distinguished as their R. A. and declination are known, and the differences of R. A. and declination are read off with great facility from the two records.

Such is the rapidity with which this work may be executed, that, in an experiment made on the evening of the ———, I recorded, in twenty minutes of time, no less than *one hundred and three* stars. The R. A. was observed on a single occulting bar, while the declination was carefully taken on the horizontal bar. I feel confident that the R. A. in no instance was out more than three-tenths of a second of time, while the declinations were as well observed as is usually done by the old methods.

I am delayed from commencing actual work in cataloguing, by not having yet received my instruments for measuring up differences of declination. Thus far I have used the micrometer of the equatorial, which only furnishes relative and not absolute results. In a few days the instrument is to be finished, and, as soon as received, I will communicate specimens of the work.

I find my disk and its appliances of signal value in the investigation of the problem of wave-time in electrical currents. I have performed a series of experiments on the following plan, which yield some very interesting results:

Two pens, with steel points, are so placed as to strike minute dots on a metal plate revolving beneath them on the disk. The sidereal clock is connected with the two local batteries driving these pens, so that the clock beats are recorded at the same absolute moment by the two local circuits. One of these pens is not changed, but remains ever in the same condition, driven by a short circuit; while the other can be placed at pleasure under the power of a circuit extending to Pittsburg and back, along the wires, a distance of 603 miles.

It was soon discovered that the adjustment of the receiving magnet exercised an important influence on the pen operated by the circuit closed by the receiving magnet. When the armature came up firmly, the pen was brought down quick; while a feeble movement of the armature caused delay in the pen, amounting to a tenth of a second, or even more. Hence it became important to adjust in such manner as to obtain equality in the force of the long and short circuits driving alternately the *variable* pen.

When this was done, the alternations were made from *short* to *long* circuits; and in case the long circuit produced any delay, it could not be detected by the ear. This was decided by the following experiment:

The persons who changed the circuits agreed among themselves as to the order of their changes. Those listening knew nothing of their private agreement, so that the judgment was unbiassed. After five minutes of trial, the operators asked what changes, if any, had been made. No one could answer, and all believed that no changes had been made; while, in reality, the changes had been effected every *ten seconds* during the whole experiment.

In case the ear can detect differences of time equal to one-hundredth of a second—which, from my own experiments, is certain—then the velocity of the wave cannot be less than sixty thousand miles per second. In case the ear can detect differences of time amounting to half a hundredth, then the limit cannot fall below one hundred and twenty thousand miles per second.

I soon discovered that the force of the electric current was subject to perpetual change of a minute character, but not to be neglected in so delicate an investigation.

This was exhibited in the armature time, as recorded by the pen, carried by an elastic handle.

Whether the changes of armature time are entirely due to changes in the current, or to differences of connexion, remains to be determined. They are, probably, dependent on both causes.

It now became necessary to cause both pens to record their armature time, and, by increasing or decreasing the local battery of the variable pen, to bring the force of the long and short circuits to as near an equality as possible.

This last experiment will be recorded on the metallic disk, and will be printed for distribution. It has been delayed by a break in the line, and as the limit in time for this report has come round, I send it unfinished.

Respectfully, your obedient servant,

O. M. Mitchel.

Dr. A. D. Bache,
Superintendent U. S. Coast Survey.

A Chapter in the History of Railway Locomotion.[*]

It has been observed by some sapient moralizer, that when a great work is to be done, a man is always found to do it—or rather, he steps forward of his own accord, and undertakes the job. Whilst we are not prepared implicitly to adhere to this wise saw, we cannot well escape its application in railway history, for it must be allowed that when, thirty years ago, the increasing commercial importance of the country demanded a proportionately improved mode of conveyance, which should combine the requisites of economy, speed, and commercial practicability, George Stephenson got up and supplied the deficiency. This he did by an extension of the embryo system then partially in use in his own district of the north of England, for the conveyance of coals to the staiths, or shipping places.

The extent of these colliery lines did not exceed four or five miles, and, looking at the imperfection of the power employed upon them, little could be said as to their chance of superseding horse labor. It cannot, nevertheless, be said, that, even at this early date, the great utility inherent in the system was not tolerably apparent to a few of those early mechanicians whose names have now become interwoven with its fame. Their acute perception enabled them to distinguish, through the then crude and imperfect state of applied mechanics, the immense resources which lay shrouded in futurity, waiting for time and human experience to develope them. The first iron railway ever laid down, to the extent of twenty-five miles, was the Stockton and Darlington line, which was opened on the 27th of September, 1825, the management of the working power, consisting of locomotives, stationary engines, and horses, being entrusted to Mr. Timothy Hackworth, of whose efforts in the introduction of locomotive mechanism we here propose to treat. Twenty miles were worked by locomotives and horses, the two classes of power being placed in competition with each other.* Owing to the inefficient condition of the locomotive power, the Company had all but determined to abandon steam in favor of horses, when Mr. Hackworth proposed to construct an engine suitable for working the traffic on this extent of line. This offer was accepted by the Company, and, by way of economy, it was determined that the boiler of Wilson's engine should be made to serve for the new one. This boiler was a plain cylinder, 13 feet in length, and 4 feet 4 inches in diameter. The heating surface was obtained from a double tube of malleable iron, in the form of the letter U, traversing the whole length of boiler. One side of this tube was made available for the fire-grate, and the heated vapor being passed through it, was returned by the opposite one to the chimney, which was actually a vertical continuation of this end. With this contrivance the engine had a heating surface double that of any other engine of its time. She was carried on six 4-feet wheels, four of them being spring-mounted, and was the earliest of the six-wheel coupled class. The cylinders, 11 inches in diameter, and 20 inches stroke, were placed vertically at what is now the smoke-box end of the engine, and worked directly upon the first pair of wheels. At the same end was attached a malleable iron cistern, into which the water passed from the tank, previous to being introduced into the boiler, the driver having the power of regulating the supply; and a pipe from the steam exhaust was led into the cistern, for the purpose of admitting steam at pleasure, to heat the water. Another pipe was provided for the purpose of leading off a steam jet from the exhaust-pipe at the chimney end, for discharge beneath the grate, the intention being to facilitate combustion.

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[*] From the Glasgow Practical Mechanic's Journal, for June, 1850.

In addition to its being the original of a class of engines now so universal, this engine was the first which had a blast-pipe fitted to it, the whole of the exhaust steam—excepting only such a portion as was required for the purposes before alluded to—being conveyed into the centre of the chimney, and there thrown out in a jet from a conical pipe. She was named the "Royal George," and commenced working in October, 1827.

As an exposition of her superiority over the horses—which, be it remembered, were at this time in the ascendant as regards their employment on railways—we may compare the actual results of the two systems of working.

Cost of "Royal George," £425; number of tons conveyed by her in one year, (1828,) 22,442 tons over twenty miles; cost of conveyance, ¼d. per ton per mile, or, including all repairs and maintenance, and interest on sunk capital, at 10 per cent., £466; an economy in working which is rarely exceeded at the present day, after a lapse of twenty-three years. The cost of the same work performed by horses was £998, showing a difference of £532 in favor of this engine over the animal power.

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* There were, at this time, five locomotives on the line; four built by Mr. Stephenson & Co., of Forth street, Newcastle, and one by Mr. Wilson, of the same place.

The points of improvement in the "Royal George" which conduced to this important result, evidencing not only her great superiority over her compeers, but the vast resources of the imperfectly developed locomotive system, were simply these: the increased evaporative surface of the boiler; the perfect command over heavy loads in all states of the weather, by reason of the superior tractive adhesion derived from the six coupled wheels; and the introduction of the blast-pipe, an invention which alone will carry down the name of Hackworth to future ages in connexion with early locomotive history.

Up to the period of which we write, no really efficient locomotive was in use, as the steam pressure invariably fell, in spite of the best efforts of the driver; and the superiority of the "Royal George," in this respect alone, at once elevated it far above its contemporaries, for it was capable of maintaining a speed of nine miles per hour throughout its run of twenty miles, in all weathers.

Amongst all the details of the locomotive, perhaps no one point has afforded so much material for speculative invention as the exhaust draft apparatus, and yet, out of the accumulation of schemes for this purpose, which have taken every devisable shape, as fanners and bellows, nothing has arisen to supersede the original blast-pipe in the smallest degree. After twenty years' experience, nothing more has been elucidated than the simple fact, that to get it as wide as possible is the ultimatum of perfection. In naming the novelties brought out in the "Royal George," we must not forget to add, that she possessed the first short-stroked force-pump, as also the first set of adjustable springs for the safety-valves, instead of weights.

To illustrate the state of popular feeling prevalent at this time in reference to the contest between locomotives and horses on the Stockton and Darlington line, we extract a few passages from a letter addressed by Mr. Robert Stephenson to Mr. Hackworth, dated Liverpool, July 7, 1828:—

"The directors having heard here, by some channel or other, not favorable to the locomotive engines, that there has always been a great number of horses on the line, and that the horses were beating the engines off,—in answer to this I understood you to say, that at one time you had completely run the horses off, but in consequence of the late accident, and the heavy engine being laid aside, you had been obliged to employ horses again. Was not this the sole cause of the horses being employed? and was there not an instance, a little while ago, of the horses being entirely removed from the line of road? Please write me by return of post, or, at all events at your earliest convenience, answers to these queries. I cannot wonder at the traveling engines having so much to contend with, when I come in contact with enemies to them every hour; and they prove to be enemies without reason, they oppose the engines merely because certain things have been said against them."

The accident alluded to in this extract was the explosion of one of the engines, supposed to have been caused by a driver having neglected to remove a spring which was employed to steady the weight upon the safety-valve lever during running, this removal being necessary whenever the engine stopped. The "heavy engine" was the "Royal George," then undergoing repairs; hence the want of the two engines involved the necessity of employing horses until the repairs were effected. In a letter written by Mr. G. Stephenson, dated Liverpool, July 25, 1828, the following occurs:—

"Brandreth has given a report here that you are going to lay off the locomotive engines. Is it so? It was a great pity that the accident took place with the tubes. We have tried the new locomotive engine at Bolton; we have also tried the blast to it for burning coke, and I believe it will answer. There are two bellows, worked by two eccentrics underneath the tender."

In the early part of the year 1829, as the Liverpool and Manchester line approached completion, the directors laid their heads together to determine on what kind of power they were to use. They had, in the previous year, formed a deputation from amongst themselves, to visit the different lines in the north of England, the counties of Northumberland and Durham being the only districts where the different systems of power were practised to any appreciable extent. It would appear that, notwithstanding the inspection by the deputation, they were yet unable to decide; and the only conclusion at which they arrived was, that owing to the great traffic anticipated on the new line, it would be impossible to work it by horses. This confined the question within narrower limits, locomotive and stationary engine power being the only systems available for choice.

To set the question at rest, two practical engineers were appointed to visit the Stockton and Darlington and Newcastle lines, and to report thereon. The engineers chosen were Mr. Rastrick of Stourbridge, and Mr. Walker of Limehouse, who accordingly made a joint report on the subject in March, 1829.

After the conclusion of their investigations, and previous to the issue of their report, these gentlemen made application to Mr. Hackworth for particulars of the expenses connected with the maintenance of the locomotive engines on the Darlington line, and when the report appeared, it contained their well-known decision in favor of stationary power.

Mr. Robert Stephenson was at this time carefully searching for evidence to support him in his opinion in favor of the locomotive system, in opposition to the report. A letter from him to Mr. Hackworth, dated March 17, 1829, refers particularly to this question:—

"The reports of the engineers who visited the north, to ascertain the relative merits of the two systems of steam machinery now employed on railways, have come to conclusions in favor of stationary engines. They have increased the performance of fixed engines beyond what practice will bear out, and, I regret to say, they have depreciated the locomotive engines below what experience has taught us. I will not say whether these results have arisen from prejudice or want of information or practice on the subject. This is not a point which I will presume to discuss. I write now to obtain answers to some questions on which I think they have not given full information. Some of their calculations are also at variance with experiments that have come under your daily observation. For instance, they state it positively as their opinion, that a locomotive engine of 10 horse power, or say, of the usual size, will not convey more than 10 tons, exclusive of the wagons, at the rate of 10 miles per hour in winter-time, and in summer the same engine will take 13½ tons. The calculation is made on the assumption of the road being level. In answer to this statement, will you be kind enough to state at what speed your own engine returns from Stockton with a given number of empty wagons, and the rates of ascent? The whole ascent will do to get an average. State also at what speed the six-wheeled engine made by R. S. & Co. will return with any given number of wagons. What load, including wagons, will an engine, weighing 9 tons, including water, take at the rate of 10 miles an hour on a level well-conditioned railway? Let it be understood that all your statements are made under the supposition that the speed is to be maintained for 20 or 30 miles without stopping, except for water. Let me have your general opinion as to the locomotive engine system. Is it as convenient as any other? Would you consider 13½ tons in summer, and 10 tons in winter, a fair performance for a good locomotive engine? You will oblige me much by answering the above questions as promptly as possible, as the discussion on the merits of the two systems is yet going on amongst the directors here."

The reply to the above letter, in answer to the several questions propounded, was the following:—

"The statement you allude to, that a complete locomotive will take but 10 tons at 10 miles per hour, is quite at variance with facts: as an opinion merely, this I would forgive. Four of our wagons, laden for depôts, frequently take from 12 to 13 tons of coals, exclusive of the wagons. Our engines never take less than 16 laden wagons in winter, and in summer from 20 to 24 and 32 laden, and can maintain a speed of 5 miles per hour, except in case of stoppages by means of horse wagons at the passing places. Engines thus loaded have frequently traveled at 9 miles per hour, sometimes more. It is unsafe to aim at speed upon a single line of railway, the danger is at the passing places. I am verily convinced that a swift engine, upon a well-conditioned railway, will combine profit and simplicity, and will afford such facility as has not been hitherto known.

"I am well satisfied that an engine of the weight you mention, will convey, on a level, in winter, 30 tons of goods, 10 miles per hour, exclusive of carriages, and 40 tons in summer, exclusive of carriages. The six-wheeled engine fitted up at the Company's works, generally takes 24 wagons, 53 cwt. to 3 tons of coals each, speed 5 miles per hour, empty wagons 24 cwt. each. The six wheels by R. Stephenson & Co.,—20 wagons, 5 miles per hour, weight as above.

"As to my general opinion as to the locomotive system, I believe it is comparatively in a state of infancy. Swift engines upon a double way, I am convinced, may be used to the utmost advantage. Improvements upon anything yet produced, of greater importance in all respects, are clearly practicable; and I am sure this will prove itself by actual remuneration to such parties as prudently, yet diligently, pursue the execution of this kind of power, with their eyes open to those alterations and advantages which actual demonstration of local circumstances point out.

"Stationary engines are by no means adapted to a public line of railway.

I take here no account of a great waste of capital. But you will fail in proving to the satisfaction of any one, not conversant with these subjects, the inexpediency of such a system. It never can do for coaching; passengers cannot be accommodated. If endless ropes are used, there will be both danger and delay. What provision can be made to answer the stretching of ropes? I have known a rope a mile and a quarter long, stretch 70 fathoms in one day. What set of apparatus will be found practically applicable to give the rope proper tension? Admit it to be possible, who would dare to be near when a mass of matter standing at rest, say 20 to 30 tons, is first put in motion by a rope moving at the rate of 10 to 15 miles per hour? It need not be added what will follow—a scene of endless confusion!

"I hear the Liverpool Company have concluded to use fixed engines. Some will look on with surprise; but as you can well afford it, it is all for the good of the science and of the trade to try both plans. Do not discompose yourself, my dear sir; if you express your manly, firm, decided opinion, you have done your part as their adviser. And if it happen to be read some day in the newspapers—'Whereas the Liverpool and Manchester Railway has been strangled by ropes,' we shall not accuse you of guilt in being accessory either before or after the fact."

To be continued.

Floating Caisson Gate at Plymouth Dockyard.[*]

We gave some time ago (Vol. XLIX, p. 441) a description of the floating caisson gate designed by Sir Samuel Bentham for the Great Basin at Portsmouth, and erected under his immediate superintendence. A similar work has just been completed for the new works at Keyham, (connected with the Plymouth yard,) by Messrs. William Fairbairn & Sons, of Manchester. We extract the following account of it from a local paper:

"The caisson is a huge hollow iron box of the form of the entrance to the lock, perfectly flat at the sides, 82 feet 6 inches long at the top, only 13 feet 6 inches wide, and of the enormous depth or height of 42 feet. The lower part of this box is formed into an air chamber, or what may be termed the lungs of the caisson, by a strong iron deck which is carried from side to side at a height of about 12 feet from the bottom, and made perfectly air-tight. The capacity of this air chamber is so adjusted that when the caisson is immersed in water, the confined air exerts a buoyancy a little in excess of the total weight of the caisson; and as, by means of sluice valves, the water is allowed to enter the inside of the caisson, and fill it from the top deck of the air chamber upwards to the level of the water outside, whatever that may be, it follows that at any point of the tide, and with any depth of water greater than that which would float it, the caisson would swim a few inches clear of the masonry. The total depth of the caisson is about 5 feet greater than the depth of the water at the entrance to the lock at high spring tide, and this space is made available for the means employed for sinking and moving the caisson. A water-tight tank is formed in this part of the caisson, capable of holding 60 to 70 tons of water, supplied to it from the water main of the dockyard; and it depends upon the presence or absence of this quantity of water in the upper tank whether the caisson remains firmly resting on the masonry, and closing completely the entrance to the lock, or floats a few inches clear of the floor, ready to be hauled by capstans into the recess in the earthwork which has been prepared."

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[*] From the London Mechanics' Magazine, for July, 1850.

The ingenious manner in which the buoyant principle is taken advantage of constitutes the most meritorious feature of this scheme, for the emission of the small quantity of water confined in the top tank, (which, by means of an ordinary valve placed in its bottom, is accomplished in about two minutes,) dispenses with the laborious and [illegible]nsive process of pumping, which has usually to be resorted to

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American Engineering—Locom

Continued from Vol. XIX, page 222.

The American locomotive differs widely from the English engine, and both systems have their points of superiority: as far as design goes, I believe the American engine may claim the first place; in execution and proportioning of details, the English engine stands unrivalled. The previous pages devoted to the Frame will show that I intend to compare the various systems; and by this comparison, and by applying the principles and theory of construction, to elucidate that which is good and commendable, and guard against what is bad.

The word "theory" has been often misapplied to investigations apparently scientific; but, in practice, not only utterly useless, but which have even proved, when the test of actual working has been applied to them, erroneous and opposed to facts. Hence the old and oft-repeated saying, "Many things are good in theory, but bad in practice," has received a semblance of truth. But in all such cases we shall find the reasoner to be misled; that he comes to wrong conclusions from correct premises; that he, not science, is wrong. Many wild schemes have been thus pushed forward,—there is the perpetual motion, the inventors of which are blind to the absurdity of creating something everlasting out of decaying materials; the multiplication of power by mechanical movements, whereby a baby is made to do the work of a 100 horse engine, the designers wholly forgetting the effect of friction and weight, and being profoundly ignorant of the fact, that power is gained at the loss of speed, and that the effect of power is the product of speed and power. There was the hydraulic railway, and the compressed air railway, in which, at certain points on the road, the boiler or reservoir, (being divided into air-tight partitions,) was to be inflated with air at an immense pressure; the use of the partitions being to prevent the two rapid diminution of pressure, and to keep always on hand some air of real high pressure. In the same proportion in which railroads have taken hold of public attention, have dreamy schemers tried to introduce impossible projects, and have caught hold of shadowy schemes, by which to attain all imaginable but impracticable ends. Such would-be inventors reason wrongly, because they do not admit into their calculations such facts, and principles which are proved by facts, as bear upon their case, either because they are ignorant of them, or because they are too infatuated on the score of their own cleverness. In either case, they are not fitted to work out a practical design, and the name of theory applied to their calculations is a misnomer.

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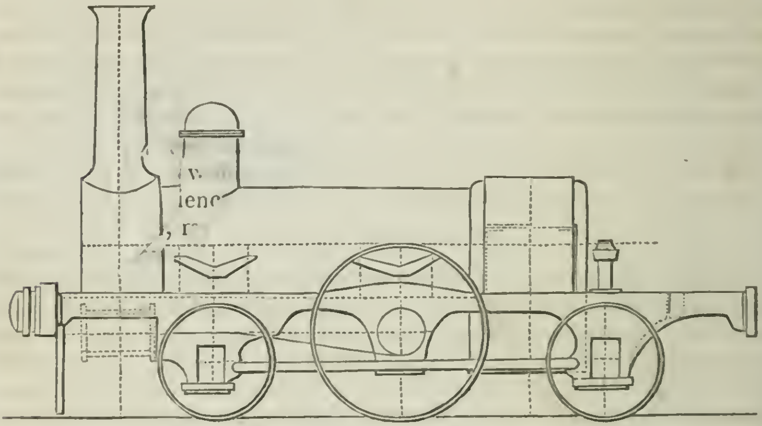
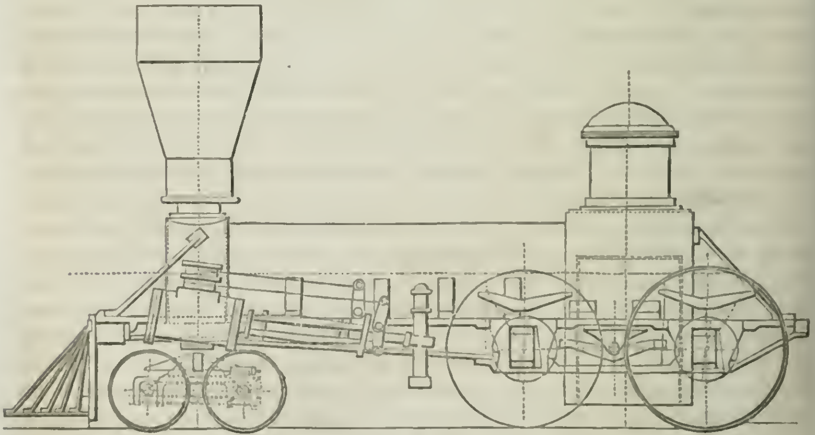
* From the Glasgow Practical Mechanic's Journal, for May, 1850.

ENGLISH OUTSIDE-CYLINDER LOCOMOTIVE.—No. 1.



1-6 inch = 1 foot.

AMERICAN OUTSIDE-CYLINDER LOCOMOTIVE.—No. 2.



1-6 inch = 1 foot.

True theory cannot be wrong, and its application to manufactures or general practice can never lead to error. For what is theory? It is the generalization of the results of experience to simple expressions, which greatly facilitate the use of former experiences in new designs. Experiment has proved the pressure of the atmosphere to average 15 lbs. to the square inch. Experiment has shown this pressure to be exerted equally in all directions. These are first principles. Arithmetical calculation being brought to bear upon them, a theory is the result, by which, for instance, an engineer calculates the area of his safety-valve. Had he no such theory, or no such generalized expression for facts, the safety-valve in every case would be constructed by guesswork, and, to test its accuracy, he would have to create a vacuum above it, raise steam in the boiler, and load the valve by means of scales, then attach his levers and weigh them till the same balance was produced. After a few such trials he would come to general results, by which he would act in future cases. That would then be his theory; but to make these experiments much science is required. Scientific men have made them, and practical men make use of their deductions—of their theories. A body heavier than water, sinks in it; one lighter than water, floats. Fluids contained in vessels of unequal size, connected at the bottom by a narrow tube, balance each other. A small power exerted at the long end of a lever overcomes a large resistance at the short end. These are called principles, or laws of nature, because in every case they hold good. Such principles, with many others, led to the construction of the hydrostatic press. Other principles were admitted into the calculation, new ones were observed, and the theory was raised by which these presses are now made of such perfection and strength. Many a mechanic uses them and makes them, and laughs at the idea that there is theory in their construction. The combination of principles forms a theory; theories classified into systems form sciences. Sciences, which—though to the unlearned are without apparent connexion—are founded upon the same elementary principles—form branches of philosophy, such as astronomy, optics, mechanics, meteorology,—all are branches of one great natural philosophy.

Every observant man has his own theory—he has derived it from his experiences through life. But if his theories are to be correct, they must be based upon correct observations, upon true—not fanciful or made-for-the-purpose—principles; and his mode of generalizing and thinking must be sound. He must have what is usually called a clear head. Two men observe that beams of various cross sections support various weights. They have to construct new ones for some purpose. They calculate the cross section according to former experience. One lays his beam on the flat side, and it breaks; the other lays it on edge, and it does not break. The calculations of both are based upon the same principles. The one, observing all facts, had formed a theory; the other had observed only half the facts, and therefore his deductions were only half a theory. Failing in practice is not a proof that one fact is worth a dozen theories, but is only a proof that the man's mode of reasoning was deficient and practically bad.

Some men have an intuitive perception of mechanical principles. Theories, which others have to acquire by study, seem to form a part of their mental organization. This we call talent. Talent is ever active—always designs. Such talent carefully cultivated, its possessors become leading men, the main props of their profession; Watt, Smeaton, Brindley, Telford, the late G. Stephenson, I. K. Brunel, Rennie, W. Fairbairn, and R. Roberts, are such men.

Let not practical men, then, turn away from my remarks, when I say I shall apply the theory of construction to the building of locomotives. Where there is no opportunity for trying experiments, reasoning must supply their place, and, if based on sound principles, must lead to the same results. In giving an opinion on an engine, I am not guided by the builder's opinion; if so, I should be led to consider every engine perfect;—but I watch them on the road and in the repairing shop, and inquire among superintendents, drivers, and workmen. My views for rendering an outside-cylinder engine steady at high speeds I stated in a former place; up to that time, the only engines of that class with which I was acquainted were English, or more or less copies from the English style. By observing them, and by reasoning, I came to certain conclusions, which, not having been tried, existed simply as theories. Arriving here, I found that experiments had been made, and such engines had been built, which were remarkably steady. My theory was, therefore, proved correct. The same results had been obtained in different countries, by different modes of handling the subject.

We find another peculiarity in all American engines, introduced as an experiment, found successful, and now universally applied. I believe it need only be known to be generally employed on all locomotives. Wherever stationary force-pumps are used, wherever a strong continuous stream of water is required, chiefly in fire-engines, which are nothing but locomotive—or loco-motive—force-pumps, this end is obtained by the use of an air-vessel. It is the simplest, most economical, and a never-failing plan; and, as far as I can ascertain, was first applied to locomotives here about five years ago, and by the same engineer whose name has before been mentioned—Mr. M'Queen. The locomotive pump consists of two pumps: one a sucking, the other a force-pump. The air-vessel is used either above the lower, or between the lower and the check-valve. Sometimes only one is used, sometimes two. It makes the pumps more efficient, and less liable to failure, in action. In the general employment of a separate cut-off or expansion valve, the American engine also differs from that of English construction. So far as I was acquainted with the continental engines of Europe, a second valve was there always used, the link motion being employed merely for reversing. Of the superior advantages of this arrangement I hope to be able to give a convincing proof.

To be Continued.

AMERICAN PATENTS.

List of American Patents which issued from August 13th to September 10th, (inclusive,) 1850, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

AUGUST.

16. For an *Improvement in Friction Clutches;* Nelson Barlow, St. Louis, Missouri, August 13.

Claim.—"What I claim as new, is the sliding collar connected to, and in combination with, the nut, substantially in the manner and for the purposes specified."

17. For an *Improvement in Cylinder Printing Presses;* Bartholomew Beniowski, London, England, August 13; anté dated October 14, 1847.

The patentee says,—"The principle feature of novelty consists in securing the type or blocks to the inner or concave surface of a cylinder, in place of the outer circumference, as has hitherto always been done. By this arrangement, the centrifugal force developed during the rapid rotation of the large cylinder has the effect of retaining my types in their proper places, rather than of deranging them, as was formerly the case.

"The second part of my invention relates to an improved method of constructing or making the inking rollers or balls used in letter-press or block printing. By my improvement I make the rollers or balls much lighter, cheaper, and more durable and permanently elastic, than the ordinary balls and rollers. To effect this, I substitute for the usual composition either India rubber or gutta percha; I make them also of some air-tight substance, which I fill with compressed air. Many substances may be used for this purpose, such as gut, bladders, impervious cloth, or sheet India rubber;—I prefer this last."

Claim.—"What I consider to be new, and therefore wish to claim, is constructing a printing machine, in which the form or forms of types or blocks are placed on, or secured to, the inner or concave surface of a cylinder or drum, which is made to revolve and carry the form or forms secured thereto from the inking rollers to the printing or impression cylinders, all of which parts are mounted inside the cylinder or drum.

"2d, I claim the methods above shown and described, of making the inking rollers or balls of printing presses or machines."

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18. For an *Improvement in the Manufacture of Candles;* A. B. Warner and J. G. Davis, assignees of James G. Davis, Buffalo, New York, August 13.

The patentee says,—"My machine consists of a cylinder fitted with a piston, by means of which the fatty material of which the candles are made is forced through a cylindrical tube in the centre of which the wick is fed; as the cylinder issues from the tube it is received upon a carriage, furnished at the extremity nearer the end of the tube with a set of knives; as the issuing cylinder strikes the further extremity of the carriage, these knives sever the piece laying upon it from the continuous cylinder issuing from the tube, and at the same time remove the fatty material from a portion of the wick, leaving the latter bare. The candle being thus finished, is thrown off from the carriage, and the latter being returned by a weight or otherwise to its first position, again receives the cylinder issuing from the tube to form a second candle."

Claim.—"What I claim as new, is the arrangement and manner of operating the knives, by which the cylinder of fat, with its central wick, is cut into suitable lengths for candles, and the fat removed from the end of the wick

"I also claim the device for regulating the length, and delivering the candles, substantially as herein described."

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19. For an *Improvement in Instruments for Vaccinating;* Junius F. Tozer, Rochester, New York, August 13.

Claim.—"What I claim as my invention, is the sliding cylinder, in combination with the thumb key, spring, and piston, for the purposes described."

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20. For an *Improvement in Splints for Fractures;* Adam Hays, Madison, Jefferson county, Indiana, August 13.

The patentee says,—"The nature of my invention is such as to enable the surgeon to keep up permanent extension and counter extension throughout the treatment necessary, so as to keep the parts in their proper relative position, and at the same time afford opportunity for dressing as often as may be necessary, without risking any displacement of parts, and thus accomplish a most important object in the management of such cases."

Claim.—"What I claim as my invention, is the cutting out a portion of the splint, to afford an opportunity for dressing as often as may be necessary, the upper and lower portions of the splint being kept firmly united by means of the brace, so as, by extensions and counter extensions, to keep throughout the treatment the proper relative position of the parts concerned, the slide being replaced after each dressing; or any other device substantially the same."

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21. For an *Improvement in Weighing Machines;* George Houston, Washington, Beaufort county, North Carolina, August 13.

Claim.—"What I claim as my invention, is the iron frame, together with the skids and regulating screw used in combination with a weighing beam, as described."

22. For an *Improvement in Packing Journal Boxes and Axles;* Wm. H. Hovey, Hartford, Connecticut, August 13.

"The nature of my improvement consists in the application to the inside of the journal box of a metallic packing ring, fitting accurately to the axle or shaft close to the journal, and acted upon by springs in such a manner as to keep it (the ring) fitting to the shaft notwithstanding the wear by friction, and to force it up to the face of the inside of the box, so as to form a tight joint, which will prevent the escape of the oil or other lubricating material from the box, and will exclude dust, dirt, &c., from the bearing."

Claim.—"What I claim as new, is the combination of the metallic packing ring, having its outer periphery of conical form, the arched springs, having their ends inclined to fit the said ring, and the regulating screws, with the journal box and the axle, in the manner and for the purposes substantially as described."

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23. For an *Improvement in Pentographs;* Allen Judd, Chicopee, Hampden county, Massachusetts, August 13.

"The nature of my invention consists in connecting a pencil with an eye-tube or telescope, so that they shall move in all directions parallel with each other, by means of which any object, over the outline of which the telescope is directed, will be traced on a paper placed before the pencil."

Claim.—"What I claim as new, is the instrument constructed and arranged as above set forth, consisting of a pencil, moving parallel with the eye-tube with which it is connected, as herein described, and marking on a vertical plane, or a plane parallel with their axes of horizontal motion, such objects as the sight through the eye-tube passes over."

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24. For an *Improvement in Bench Hooks;* W. B. Kean, Worcester, Massachusetts, August 13.

"The nature of my invention consists in a spindle provided with a head, having four or any other suitable number of edges passing through a hollow metal socket secured to the bench, in a position slightly deviating from a line perpendicular to the surface of the bench; the lower part of the spindle is screwed and fits into a female screw in the lower part of the socket, the upper part of which fits in a cylindrical guide in the upper part of the socket; the four edges of the head are formed to suit various descriptions of work, and under each edge in the part of the spindle above the screw, is a groove into which a spring catch attached inside the socket fits. The head may be adjusted by the screw on the spindle at any height, and either edge may be set to the work, being secured in any position by the spring catch; the front edge will, owing to the inclined position of the socket, always be highest, and the back edge always lower, so as to be clear of the work."

Claim.—"What I claim as new, is forming the head with any suitable number of edges, of any required form, to suit various kinds of work, and having the spindle, of which the head forms part, grooved and fitted in a socket set at an inclination to the bench, so that any edge of the head can be set to the work, and secured by a spring catch, and whatever edge is turned to the work will be higher than the back or opposite edge, as herein set forth."

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25. For *Improvements in Apparatus for Regulating the Setting of Bows in Wagon Tops;* A. M'Kinney, Montgomery, Orange county, New York, August 13.

"The nature of my invention consists in a frame provided with certain adjustable rules and hold-fast bolts; the frame is intended to be secured to the seat of the wagon; the hoops are set at the required height and distance from each other, plumbed and squared by the adjustable rules, and held by the hold fast bolts until they can be secured to the body of the wagon."

Claim.—"What I claim as new, is the combination and arrangement of the rules, the rods, the pins, the adjusting screws, and the hold-fast bolts, arranged and adjusted upon a frame, in the manner and for the purposes substantially as herein described.

"And I also claim the adjustable rule sliding in the swinging bar, and attached to the same frame with the before described combination, in the manner and for the purposes herein set forth."

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26. For an *Improvement in Ornamenting Textile Fabrics;* Robert Milligan, Harden, England, August 13; anté dated March 18, 1850.

Claim.—"What I claim as my improvement, is the new or improved ornamental fabric or manufacture, made substantially as specified, viz., having any ground suitable or unsuitable for receiving and exhibiting bright color or colors when imprinted thereon, and having figures, stripes, or other portions of surface floated over the said ground in material and color suitable for representing such bright color or colors, and having such bright color or colors printed on the said floated surfaces."

27. For an *Improvement in Piano Fortes;* James Pirsson, City of New York, August 13.

"The nature of my invention consists in certain improvements in piano fortes, said improvements having for their object the increase of the power of the instrument, both as to sound and the number of performers who may jointly operate upon it. The general arrangement and principle involved is uniting in one case two sets of grand actions, operating upon strings combined so that the vibrations shall be produced upon one general sounding-board, whereby the surface of vibration is greatly extended, as, within proper limits, the larger the sounding-board the greater will be the depth and volume of sound produced."

Claim.—"What I claim as of my own invention, is combining two sets of strings, operated by separate actions, with one and the same sounding-board, whereby I am enabled to produce greater effects, both in quality of tone and in power, than heretofore, and also to maintain the unison of the notes, and the tone, to a degree not possible before; the whole being constructed and operated substantially in the manner described herein."

28. For an *Improvement in Ship Ventilators;* Warren Robinson, Lebanon, New London county, Connecticut, August 13.

"The nature of my invention consists in placing a number of tubes or other air ducts along the inside of the hull of a vessel in a vertical position, running from that part of the vessel which it is proposed to ventilate up to the bulwarks above the upper deck, and there discharging into a chamber, said chamber being so arranged with a register and valves that a free egress and ingress of air is permitted, while at the same time the water is effectually excluded."

Claim.—"I claim, 1st, the ventilating chamber constructed in the manner substantially as above described, having a tube or air passage communicating with the cabin or 'between decks' of a ship or other vessel, and provided with a register, either for the purpose of admitting pure air by long tubes to the lower parts of cabins or 'between decks,' or for carrying off the ventilated air by short tubes from their upper parts.

"2d, I do not claim the use of a float-valve in the ventilating tube, irrespective of the manner of applying them, but I claim having the two float-valves attached together in the manner substantially as described, and each acting independently of the other, upon a separate seat in the ventilating chamber, so that any water passing one valve may be shut off by the other."

29. For a *Safety Apparatus for Steam Boilers;* John C. Tennent and John Workman, Philadelphia, Pennsylvania, August 13.

Claim.—"What we claim as our invention, is the application of a rope made of any combustible material, (using for this purpose wool, as prepared in the manner before noticed, or any other material which will answer the intended effect,) to the upper surfaces of one or more tubes or flues of a boiler, which, when said tubes or flues are uncovered of water, will burn off or part in the manner as before described, for the action of the excessively heated metal and surcharged steam, which the rope is connected with, and by its parting actuates the apparatus herein described, or any part thereof, for the purpose either of giving alarm, or putting in action means of safety, or both, substantially as herein described."

30. For *Improved Serving Mallets;* Thomas Batty, City of New York, August 20.

"The nature of my invention consists in the attachment of a series of grooved friction rollers around that part of the head of the serving mallet on which the spun yarn is wound, the grooves in the rollers being to guide the spun yarn; the object of the rollers is to reduce the immense friction which renders the use of the ordinary serving mallet so extremely laborious, and wears out the mallet so quickly.

"It further consists in making the groove in the face of the mallet deeper at the end which covers the served part of the rope, so as to give the mallet an even bearing, and make it finish the work more closely."

Claim.—"What I claim as my invention, is, 1st, attaching friction rollers to the periphery of a serving mallet, substantially in the manner and for the purposes herein described.

"2d, Making the groove or face deeper or larger at the part which fits the served part of the rope, in the manner and for the purposes substantially as herein described."

31. For *Improvements in Gun Harpoons and Lances;* Robert Brown, New London, Connecticut, August 20.

"My invention and improvement consists, 1st, in attaching a tail of short cords, or their equivalents, to the butts of gun lances in such manner that the cords can be laid by the side of the shank, loaded with it into the gun, and fired therefrom; the tail thus arranged will, during the flight of the lance, be extended behind it, and operate as a drag on its butt end, keeping the latter back and the point forward, thereby rendering its flight in the direction in which it is aimed more certain.

"Experiments have shown that the shoe or button at the butt end of harpoons and lances prevents the lines attached thereto from trailing, during their flight, as nearly in a line with the shank as they would if left free to assume their positions without obstruction from the button; and likewise, that these buttons greatly retard the flight of the harpoon or lance, by the great area which they oppose to the action of the air.

"The object of the second part of my invention is to remedy these defects, and it consists in making the button separate from the shank, and so attaching it thereto that it shall fall therefrom very soon after the lance leaves the muzzle of the gun."

Claim.—"What I claim as my invention, is attaching a tail or cords, or their equivalents, to gun lances, substantially in the manner and for the purpose herein set forth.

"I also claim attaching the button to the shank of gun harpoons or lances, in such manner that when the lance or harpoon is discharged from the gun the button will drop off, being thereby prevented from retarding the flight, and from deflecting the lance or harpoon from the line in which it is projected from the gun, substantially as described."

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32. For an *Improvement in Obstetrical Supporters;* Francis S. Chase, Clintonville, and Adam Weston and Leander Babbitt, Au Sable, Clinton county, New York, August 20.

"The nature of our invention consists in the combination and arrangement of an instrument denominated an 'obstetrical supporter and assistant,' designed to support and relieve a woman during parturition; and render delivery easier, more speedy, and safer, being so constructed as to adjust perfectly to the body and limbs, and protect the os coxix from all pressure of the fœtus, and thereby enlarge the measurement of the pube cóxigeal space, secure to the patient a pliant and comfortable seat and posture, support and comfort to the back, the sacrum and the hips, and prevent those distressing pains of the thighs, which frequently occur in delivery under ordinary treatment."

Claim.—"What we claim as new, is the combination in the manner described, of the sliding plate with the back pad which is connected to the seat, for the purpose of enabling the bearing of the instrument to be moved higher up or lower down the back, without disturbing the patient."

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33. For a *Method of Propelling Boats in Shallow Water;* John Dougherty, Mount Union, Huntingdon county, Pennsylvania, August 20.

Claim.—"What I claim as new, is, 1st, the combination and arrangement of the setting pole, sliding in the sheath, with the spring bolt and cords, for the purpose of shortening or lengthening the setting pole, substantially as described.

"2d, The manner described of checking or snubbing the boat, by means of a chain or cord attached to the foot of the setting pole, and passing over pullies to a windlass placed in the stern of the boat, near to the helm, as described."

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34. For an *Improvement in Compound Wagon Boxes;* Imla Drake, Mansfield, Warren county, New Jersey, August 20.

"My invention consists in the application of jointed screw bolts of adequate strength, attached by eyes, hooks, or any other convenient and equivalent device, to the axles, frame, or other solid parts of the vehicle, and capable of being laid down or set up at pleasure, and of such length as, when standing erect, to extend above the top of any load intended to be carried, and combined with the parts hereinafter mentioned."

Claim.—"What I claim as my invention, is making the fastenings of a compound wagon body, by combining with screw bolts, so jointed to the axles, frame, or body of the carriage as to be laid down or set up at pleasure, two cross pieces to each pair of bolts, with pressure nuts above the upper, and sustaining nuts beneath the lower, cross bar, whereby the whole load may readily and easily be secured, or the lower part may be released and withdrawn, without disturbing that which is above it, substantially as herein set forth."

35. For an *Improved Steam Boiler;* Richard E. Dibble, City of New York, August 20; anté dated July 20.

"The object of my invention is to maintain a constant and rapid circulation of the water in a tubular steam boiler, through the tubes and through a series of water vessels, which depend from the roof of the fire box, and expose a very large surface to the direct action of the fire."

Claim.—"What I claim as my invention, is the arrangement of pendent water vessels in the fire box, in combination with water tubes which pass along the flue, and are connected at one extremity with a water space near the back of the boiler, and at the other with the water vessels at the fire box, substantially as herein set forth."

36. For an *Improvement in Changing Rotary Motion into Reciprocating Motion;* Isaac D. Garlick, Lyons, Wayne county, New York, August 20.

Claim.—"What I claim as my invention, is the mechanical arrangement and combination of parts by which I convert the rotary motion of the wheel into a reciprocating movement of the churn dasher-rod, to wit: by means of the action of the lugs, that project from the face of the said wheel, upon the forked rocker and the vibrating beam, when aided by the inclined planes, substantially in the manner set forth."

37. For an *Improvement in Machines for Cutting Hemp;* J. Locke Hardeman, Arrow Rock, Saline county, Missouri, August 20.

"The nature of my invention consists in the construction of a machine by which the hemp is cut and deposited in bunches, out of the way of the succeeding course of the team of horses by which it is drawn, and the track of the machine."

Claim.—"What I claim as my invention, is the attaching a series of blades upon an arm back to back, in a V-form, their edges elevated in order to give a smooth glancing stroke upward through the stalk of hemp, after the manner of the cutting performed by the common scythe in hemp or grain.

"I also claim the introduction and use of a cleaning shear over the crotchet or junction of the blades, to remove such hemp as may be imperfectly cut or pulled up, substantially in the manner as set forth.

"I claim the method of separating and bunching the hemp after it has been cut, by means of a wedge or inclined plane, and a revolving cone.

"I claim the invention and use of the revolving rack as a substitute for the over-head reel, in supporting the hemp while being cut."

38. For an *Improvement in Fulling Mills;* John C. Millar, Springfield, Hampden county, Massachusetts, August 20.

"The nature of my invention consists in running a horizontal wheel, with buckets or ribs on its outer face, within a tub or cistern, said cistern also having buckets or ribs projecting from its inner face towards the centre wheel, as seen in the drawing, leaving, however, a space between, for the cloth to roll in a mass as the wheel turns. The improvement made is in avoiding all rubbing friction, and consequestly all wear of the fabric, in the process of fulling or washing; this is readily demonstrated by turning the wheel with a bit of cloth or paper placed in the tub."

Claim.—"What I claim as my invention, is so arranging a vertical fluted or ribbed cylinder, and fluted or ribbed concave, that the rotation of the former on its axis shall cause the goods to be fulled to assume a cylindrical form, and to rotate on its own axis, by means of the friction of the two fluted or ribbed surfaces acting upon, and sustaining in its position, the cloth or goods, as set forth."

39. For an *Improvement in Machines for Cutting Crackers;* William R. Nevins, City of New York, August 20.

"The nature of my invention consists in giving the rollers a constant velocity, and adjusting the number of strokes of the cutters thereto; and also in adjusting the feed of the apron to the number of strokes of the cutters."

Claim.—"I claim the combination of the three following elements, viz., 1st, the constant velocity of the breaking rollers.

"2d, The number of strokes of the cutters adjustable thereto, by means substantially as described, so that, within certain limits, they may be varied in relation to the number of revolutions of the feed rollers.

“3d, An adjustable feed to the apron, derived from the shaft carrying the cutters, so that it always makes the same number of strokes, but each stroke may be varied in length, by which, in the same machine, I am enabled to cut crackers of any given size.”

40. For an *Improvement in Preparing the Face of Metallic Types, Engraved Plates, &c.;* Luke Vanderveer Newton, City of New York, August 20.

“The nature of my discovery consists in a new method of coating the wearing surfaces of ordinary printing types, stereotype plates, and other plates, whether engraved or cast, so as greatly to prolong the wear of said types and plates in the process of printing or taking impressions from them. This object I attain by plating the surface of the type, stereotype plate, picture cut, or other device, on those parts which are subject to the action of the printing press, with a metal more durable than the type, plate, &c., is itself composed of; and the means I employ to effect this is galvanic electricity.”

Claim.—“What I claim as my invention and discovery, is the plating or coating of the surfaces of metallic printing types, stereotype plates, or other printing plates, whether cast or engraved, with an additional coat of metal, by means of galvanic electricity, in the manner and for the purpose described.”

41. For an *Improvement in Hot Air Registers;* George Pollock, Roxbury, Norfolk county, Massachusetts, August 20.

Claim.—“What I claim as new, is the method of moving the dampers in registers or ventilators, by means of the slider and the oblique bars, with their several forms and parts, substantially as described, in combination with the oblong dampers hung in the middle of their width, in the manner and for the purposes herein set forth.”

42. For a *Register for Steam Boilers;* Jas. D. Rice, Philadelphia, Pennsylvania, August 20.

“The nature of my invention consists in connecting a registering apparatus, combined with a steam pressure gauge and water line gauge, to the gauge line of steam boilers, in such manner as, by opening and closing the gauge cocks, the pressure of steam and the height of water of steam boilers, and also the intervals of time elapsing between trying the gauge cocks, shall be registered upon paper or other suitable material.”

Claim.—“What I claim as my invention, is connecting the gauge rods with the gauge cocks in such manner, as herein described, that the pressure of steam and height of water shall be registered each time the gauge cocks are tried, the register indicating at the same time the period of time of trying the gauge cocks by opening and closing them.”

43. For a *Machine for Cutting Sheet Metal, &c.;* Stephen P. Ruggles, Boston, Massachusetts, August 20.

Claim.—“What I claim as my invention, is the toothed rack or its equivalent, applied to the bar, and a system of one or more gears, or the mechanical equivalents thereof, applied to the cutter wheel, and made to engage with the said racks or equivalents therefor, in combination with the said bar, the cutter wheel and its sliding carriage; the same being substantially in the manner as above described, and for the purpose of causing the cutting periphery of the rotary knife to travel around faster than the knife moves horizontally, and thereby to make said knife cut with a drawing stroke.

“I also claim the combination of the swinging frame and gauge contrivance, or equivalents therefor, with a sliding carriage, its cutter wheel, and the slide bar and straight cutting edge, as substantially specified; the same being for the purpose of enabling me to cut either circular or curved work, as described, and of any diameter or dimensions capable of being produced by the machine, of whatever size it may be made.”

44. For an *Improved Opening and Closing Bucket for Paddle Wheels;* George Tingle, City of New York, August 20.

“The nature of my invention consists in certain improvements in the propelling wheels for steam vessels, the said improvements having for their object the production of a better action of the floats or buckets upon the water than the old modes, in order that the angular action of said floats may be measurably overcome, and all jar, shocks, and undue commotion in the water be avoided, as well as that the ability to give a greater depth or immersion to the said floats may be obtained, and thereby secure a greater hold upon the water."

Claim.—"What I claim as of my own invention, is, 1st, the formation of each of the blades composing the bucket so that their inner or closing ends shall be heavier than the outer ends thereof, when combined with a stop or stops, substantially as herein described, thus effecting the closing together of the same by the action of gravity before entering the water, as set forth.

"And 2d, I claim curving the inner edges, so as to insure the closing of said edges together by the action of the water while backing, and thus complete a sufficient bucket for that purpose, substantially in the manner described herein."

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45. For *Improvements in Machines for Heading Bolts, Rivets, &c.;* John Van Brocklin, Middleport, Niagara county, New York, August 20.

"The nature of my invention and improvement consists in forming in the lower portion of a box or holder of a hand lever, a flaring or bell-mouthed cavity, for the purpose of embracing the upper tapered ends of the dies when the hand lever is down or nearly in a horizontal position, and the movable jaw closed by a cam lever, by which the dies are clamped firmly together during the operation of heading the bolt, while at the same time the ends of the dies act as a guide, to cause the holding and heading box to assume its proper position before the descent of the piston header or swage, and prevent the metal being forced out between the top joints of the dies and bottom of the cavity during the operation; the heading of the bolt being effected by means of a swage or piston header, made to descend by the action of a sledge or hammer, which expands the end of the bolt laterally in the lower portion of the opening in which the piston header moves, and thus forms the head of the bolt between it and the ends of the dies; the size of said opening in which the piston moves governing the lateral expansion of the metal, and hence the size of the bolt-head. The bolts being headed, the hand lever is raised to a vertical position, and the movable jaw opened by the cam lever, and the headed bolt or bolts discharged from between the dies."

Claim.—"What I claim as my invention, is attaching to, or forming in, the lower part of the box or holder a flaring or bell-mouthed cavity, which embraces the tapered ends of the dies when the box is down or in a vertical position, and clamps them firmly together, while at the same time the cavity acts as a guide to cause the heading box to assume its proper position, and prevents the metal from being forced out between the ends of the dies and bottom of the cavity in the box during the operation of heading."

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46. For an *Improved Method of Carrying Vessels over Shoals;* J. A. Winslow, Roxbury, Norfolk county, Massachusetts, August 20.

"My invention consists in an improved method of transporting large vessels over bars or shoals, where the depth of water is too small to admit of their passing without lightening or otherwise decreasing the draft, by means of a steam camel tug, which enables the vessel to be taken over the bar partly sustained by her own buoyancy in the water, and only receiving so much assistance from the camel as is necessary to reduce the draft to the depth of water on the bar, at the same time having great facilities for getting the vessel in and out of the camel, and, when in process of transportation, protecting the vessel and apparatus from injury by heavy seas, and giving such speed that the vessel shall not be materially delayed by the operation."

Claim.—"What I claim as new, is the mode or method of transporting a vessel across shoals or bars, by means of a camel having an unyielding platform for the vessel to rest on, and likewise provided with a bow, as herein described, the vessel being partly water-borne and partly supported by the camel."

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47. For an *Improvement in Processes for Making Stannates of Potash or Soda;* James Young, Manchester, England, August 20; anté dated December 9, 1848.

Claim.—"I claim as of my said invention, the mode of producing a stannate of soda by heating a mixture of tin ore and sulphuret of sodium, and a stannate of potash by heating a mixture of tin ore and sulphuret of potassium, and afterwards separating the sulphur from these mixtures respectively by means of a metallic oxide, in the manner described."

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48. For an *Improvement in Expansible Bitts;* Clinton L. Adancourt, Troy, New York, August 27.

"The nature of my invention consists in making expansible bitts for boring conical holes any given distance into the material, and clip the core, so that it is discharged from the hole without the necessity of boring through the material, making it so that tenons may be firmly wedged into mortises, and the tenon entirely enclosed."

Claim.—"What I claim, is the herein described expansible bitt, in combination with the single or double collar or tube, constructed and operating in the manner substantially the same as herein set forth."

49. For an *Improvement in Obstetrical Chairs and Supporters;* Asa Blood, Janesville, Rock county, Wisconsin, August 27.

"My invention consists in dividing the seat of the chair into sections, which are hinged together at their hinder extremities in such manner that they can be separated at the front of the seat to form any required angle with each other, and in the several devices connected with the chair, which assist in the process of parturition."

Claim.—"What I claim as my invention, is an obstetric chair with its seat composed of sections hinged together, substantially in the manner and for the purpose herein set forth.

"I also claim a chair-back, hinged to the seat in such manner that it can turn both horizontally and vertically, substantially in the manner herein set forth.

"I likewise claim the combination of the stirrups with the abdominal pad, substantially in the manner and for the purpose herein set forth."

50. For an *Improvement in Turning Up the Steps of Omnibusses;* Stephen Burdett, City of New York, August 27.

Claim.—"What I claim is the turning up of the step (it being properly prepared for the purpose) by the action of the spiral or other spring upon the stepping off of the passenger, and the withdrawing of the driver's foot, and its connexion with the brake apparatus, thus preventing boys or others from riding on it: the whole being attached to the body of the carriage, and operating substantially as fully set forth."

51. For an *Improvement in Machines for Cutting Straw;* Harry Camp, Newton, Newton county, Georgia, August 27.

Claim.—"What I claim is, 1st, the manner of hanging the knives to the wheel, as described.

"2d, Forming the knives with a hook-shaped end, in the manner and for the purpose set forth.

"3d, The collar on the projecting end of the mouth-piece, forming a support for the detached end of the knife to rest against, as described."

52. For an *Improvement in Revolving Coal Grates;* John B. Chollar, West Troy, Albany county, New York, August 27.

"The nature of my invention consists in making the grate hollow in the usual form of a cylinder, the bars surrounding it at an angle of about ten degrees more or less from the right angle with the axis of the cylinder, similar to a screw-thread, each circuit of the thread being disconnected from the next succeeding one, its two ends joining together, and a proper space left between the bars."

Claim.—"What I claim as new, is the manner of arranging bars or flanches around the cylinder, at an angle of any desired degree from the axis of the cylinder, so as to move the coal alternately in opposite directions; the same forming a fire grate, in the manner and for the purpose substantially the same as herein described."

53. For an *Improvement in Self-Generating Gas Lamps;* Sharpless Clayton and Yarnall Baily, West Chester, Chester county, Pennsylvania, August 27.

"The nature of our invention consists in forming a beautiful gas-light from fluid, by extending a wick through the common fluid lamp tube into a spheroid or other shaped ball or cavity, in which it is coiled, giving an opportunity of generating gas, by means of two or three small jets, from small apertures or holes underneath the ball which are lit in the usual way, by means of heat."

Claim.—"What we claim as our invention, is the extension of the wick into a ball or cavity where the gas may be generated by means of jets, as above set forth."

54. For an *Improvement in Coal Stoves for Roasting, Baking, and Boiling;* Thomas G. Clinton, George H. Knight, and Edward H. Knight, Cincinnati, Ohio, August 27.

Claim.—"What we claim as new, is, 1st, the arrangement after the manner and for the purposes herein described, of a grated or other more or less open fire-back, whereby a roasting surface is presented to the interior of a stove.

"2d, The provision substantially as described of dampers, whereby the roasting surface may be regulated or entirely closed up or opened at pleasure.

"3d, The falling grate, arranged and constructed substantially as described, so as to enable extension horizontally of the body of the fire for a boiling surface.

"4th, The fire door having hopper-sides, and forming, when extended, a canopy for the conduction of effluvia.

"5th, The hopper or funnel-shaped door, as arranged and here applied for the insertion of fuel."

55. For an *Improved Lock for Fire Arms;* Nathan B. Cook, Chicago, Cook county, Illinois, August 27.

"The nature of my invention consists in the fact that I so construct and arrange the machinery of the lock of a revolving or other fire arm, that, by pressing upon the trigger with the finger, the hammer is brought back to cock, and the finger may then be removed and the trigger allowed to pass forward, while the hammer is retained in its position by the seer, and may then be discharged by a light touch of the finger upon the trigger, enabling the operator to fire with all the ease and steadiness secured by the use of the hair trigger, or admitting of being fired, when expedition is desired, by one continuous pull or pressure of the finger upon the trigger."

Claim.—"What I claim as new, is the seer in combination with the pin and shoulder on the trigger, by which arrangement the hammer, after being brought back by the pressure of the finger upon the trigger, is held in its position by the seer while the trigger passes forward, and the piece is discharged by a light touch of the finger upon the trigger, securing deliberation and certainty of aim, or may be discharged by one continuous pressure of the finger upon the trigger, at the pleasure of the person using the same."

56. For an *Improvement in Shirt Studs and Buttons;* Benton P. Coston, Philadelphia, Pennsylvania, August 27.

"My said invention consists in making the shank of the stud of a peculiar shape, whereby it is readily attached to, and securely held on, the garment."

Claim.—"What I claim as my invention, is constructing the shanks of shirt studs and buttons, in the manner and for the purpose herein set forth."

57. For an *Improvement in Stoves with Circular Shaking Grate;* Edward B. Finch, Peekskill, Westchester county, New York, August 27.

"The nature of my invention consists in having the bar which supports the circular rotary or shaking grate, cast with, and forming part of the top plate of the ash box, and in providing a sliding segment for the purpose of closing the slot or aperture in the seat, through which the lever for shaking the grate works."

Claim.—"What I claim as new, is casting the seat of the fire box separate from the top plate of the ash box, having the bar carrying the centre or pin for supporting the grate cast with, and forming part of, the top plate of the ash box, substantially as described and for the purposes set forth."

58. For an *Improvement in Cast Iron Car Wheels;* Albert Fuller, Boston, Massachusetts, August 27.

Claim.—"What I claim as my invention, is making the two plates which connect the hub and rim of a cast iron railroad wheel in a series of lateral arching sectors, connected by the curved partitions, in the manner and for the purpose specified."

59. For an *Improvement in Detaching Horses from Carriages;* John W. Harrison, Logansport, Cass county, Indiana, August 27.

Claim.—"What I claim as my invention, is the application to buggies and other vehicles drawn by horses or other draught animals, of a new and useful improvement on the swingletree, which I entitle the safety swingle-tree, together with its apparatus, consisting of a lever and king-bolt, a grooved-headed screw-bolt, a flat-headed screw-bolt, a force spring, and two stirrups, combined as above described, which, upon the king-bolts being raised as above described, will allow the horse to become unhitched, and to pass off freely from the same and every part thereof, without danger to the same or to persons therein contained; using in the construction ot the same wrought iron or any other durable material that will insure the desired effect."

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60. For an *Improvement in Grain Dryers;* John R. Hoopes, West Philadelphia, Philadelphia county, Pennsylvania, August 27.

"The nature of my improvements consists in arranging horizontally a series of six or more drying plates, connected with each other by tubes forming passages for the grain, and having flues passing under and above them forming grain chambers; and a vertical shaft passing through the centre of the plates and chambers, (which is made to revolve by a band passing around a pulley at its upper end,) to which is attached a series of arms or flanches, one to each chamber; these curve alternately in opposite directions, producing a centripetal and centrifugal motion to the grain, drawing it through the respective passages leading from each chamber, and keeping it in constant agitation, preventing it from adhering to the plates or burning, as hereafter more fully described."

Claim.—"What I claim as my invention, is the arranging a series of drying plates one above another, connected by passages as described, in combination with the vertical shaft and arms thereon, curving alternately in opposite directions, combined and arranged in the manner and for the purpose set forth."

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61. For an *Improvement in the Mode of Cleansing and Drying Gum Elastic or Cloth Bands in Calico Printing;* Jeremiah Knight, Providence, Rhode Island, assignee of James Hunter, Blockley township, Philadelphia county, Pennsylvania, August 27.

"The nature of my improvement consists in the arrangement of some suitable apparatus, by which the endless gum elastic or vulcanized India rubber or other bands or cloth, after passing through the printing machine, and receiving the surplus coloring matter upon them, are made to pass over rollers and other convenient contrivance revolving in water, and thence between two squeezing rollers, one of which has a doctor or scraper attached to it. The effect is to remove the coloring matter from the cloth, while the rollers and scraper partially dry it and remove from the surface any thread or lint which may still adhere, and the band or blanket, thus cleansed, returns to the printing machine in a condition to perform its portion of the work without imperfection."

Claim.—"I claim as my invention the arrangement of the rollers and vat above described, for washing the India rubber bands, or other endless blankets, used in calico or other printing, said rollers being only partly immersed in water, and other parts being arranged and operated as set forth."

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62. For an *Improvement in Saws;* Hazard Knowles, Washington City, D. C., August 27.

"The nature of my invention consists in the improvement in saw-teeth substantially as represented in the drawings and hereinafter set forth, viz., the cutting edges of the teeth projecting forwards, with an outward inclination from plane or curved surfaces (separated by notches) a distance equal to the thickness or chip that each tooth is intended to remove, which plane or curved surfaces should be on a line, straight or curved, with each other, and parallel, or nearly so, with an imaginary line drawn over and touching the cutting edges of the teeth."

Claim.—"What I claim as my invention, is my improved saw-teeth, constructed and operating substantially as herein described, viz., the cutting edges of the teeth inclining outwards from plane or curved surfaces, a distance equal to the thickness of chip that each tooth is intended to remove from the wood, and being prevented from taking a deeper hold upon the wood, at the same time that they are strengthened by the said outer surfaces, in consequence of these surfaces being in a line with each other, and parallel, or nearly so, with an imaginary right line or circle drawn over and touching the points of the saw-teeth."

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63. For a *Self-Acting Adjustable Feed-Gear for Drilling Machines;* Alden R. Morrill and Hiram Baldwin, Nashua, Hillsborough county, New Hampshire, August 27.

Claim.—"What we claim as our invention, is the combination substantially as described, of the splined screw, the splined shaft, the smooth wheel, the toothed wheel carrying a nut, the arm, the catch, the small arm, the spring, and the segment, so as to form a self-acting adjustable feed for boring or drilling machines."

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64. For a *Method of Attaching Yards to Trusses;* Tilgath Odeon, Portsmouth, Virginia, August 27.

Claim.—"I claim suspending the yard to the truss by means of linked and swiveled eye-bolts, whereby the yard may either be allowed to hang freely below the eye which is swiveled to the truss, or may be slung upward and inward towards the mast, so as to bring its centre above the bowed end of the truss, in the manner and for the purposes herein set forth."

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65. For an *Improvement in Electric Telegraph Manipulators;* Austin F. Park, Troy, New York, August 27.

"The nature of my invention consists in arranging machinery for closing and breaking an electric telegraph circuit in transmitting intelligence, whereby the operator, by giving a finger key one instantaneous touch, as distinguished from the prolonged touch applied to the key in ordinary machines, closes and breaks the electric circuit, at and during such time as is required to signal or record a telegraphic sign for a letter, figure, or other character."

Claim.—"What I claim as my invention, is, 1st, the two guides with their hook and detent spring as described, in combination with the movable connecting points and the type forms for letters, substantially in the manner and for the purpose set forth, the guides being disconnected as soon as the movable connecting point has passed them, thereby causing the finger key rods to resume their proper position to be again acted upon, and allowing the succeeding points to pass in their regular revolving course without coming in contact with the type forms.

"2d, I also claim the manner of disconnecting the two guides, viz., by the action of the movable connecting point upon the detent spring, as above described.

"3d, I claim the employment of a clicking apparatus to indicate the proper time of depressing the keys; the whole being constructed and arranged in the manner and for the purpose substantially as herein set forth."

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66. For an *Improved Arrangement of Dampers in Cooking Stoves;* Henry L. Sheperd, Dayton, Montgomery county, Ohio, August 27.

"My improvement is for the purpose of more effectually distributing the heat over the surface of the oven and through its interior, especially when a division is introduced horizontally therein. For this purpose I divide my draft and arrange my flues as about to be described; by which arrangement I keep up an active draft, and direct the heat in all directions with equal facility."

Claim.—"What I claim as new, is the vertical dampers placed below the top of the oven in the division partitions, substantially as described."

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67. For an *Improvement in Blowers of Franklin Stoves;* W. P. Cresson, assignee of David Stuart, Philadelphia, Pennsylvania, August 27.

Claim.—"What I claim as new, is, 1st, the inner doors or blowers made to slide in grooves within the front plates of the stove; serving, when closed, as a blower, and when not in use being withdrawn out of the way and out of sight, substantially in the manner and for the purposes as above described."

RE-ISSUES FOR AUGUST, 1850.

1. For an *Improved Concealed Trigger for Fire Arms;* Jacob Pecare and Josiah M. Smith, City of New York; patented December 4, 1849, re-issued August 13, 1850.

"The nature of our invention consists in so constructing a repeating or revolving pistol that the concealment of the trigger, hitherto unattained in revolvers, but particularly desirable in that kind of pistol, is effected, thus securing in an unusual degree efficiency of action, security from accidental discharge, and portability."

Claim.—"What we claim as of our invention, is the construction of a concealed trigger, capable of being disclosed and made ready to operate by simple pressure imparted by the hand to its rear end, as described herein."

2. For an *Improvement in Harvesters of Clover Heads and other Grain;* John Hinton, Pack's Ferry, Monroe county, Virginia; patented May 22, 1849, re-issued August 13, 1850.

"The nature of my invention and improvement consists in a novel combination and arrangement of an adjustive pendent bar, to which is secured a row of parallel metallic fingers and a knife or cutter, and right-angled mortised plates, and in the arrangement of spring conveyor bars, attached to the axletree of the propelling wheels and rotating with the same, by which the stems or stalks of clover, wheat, or other grain, are carried rearward against the knife between the parallel fingers,—severed and conveyed into the receiver while the machine is progressing."

Claim.—"What I claim as my improvement, is, 1st, the combination and arrangement of the transverse pendent finger bar, the mortised right-angled plates, the adjustive slide bars, and knife or cutter, with the revolving axletree of spring conveyor bars, arranged and operating in the manner described, by which the heads of clover, wheat, and other descriptions of grain, are severed from the stems or stalks, and delivered into a receiver.

"2d, I also claim the combination of the right-angled rods, fingers, and pendent bar, with the transverse timber, for adjusting the knife and fingers longitudinally and vertically in connexion with the spring conveyor bars, as described."

3. For an *Improvement in Cooking Stoves;* Darius Buck, Albany, New York; patented May 20, 1839, re-issued August 27, 1850.

"The first part of my invention consists in making a heating chamber or flue in front of the oven of this class of stoves, which heating chamber or flue communicates at bottom with the direct and return flues under the oven, so that the passage of the products of combustion through the direct flue into the return flue will have the effect to produce a condition of heat in the said heating chamber, and thus heat the front of the oven.

"And the second part of my invention consists in extending the oven under the open hearth or apron, to enlarge it proportionally to the other parts of the stove, when this is combined with the direct and return flues at the back and bottom of the oven, and the heating chamber in front of the oven, by means of which the enlargement of the oven is heated equally, or nearly so, and thereby rendered more useful by reason of baking more equally."

Claim.—"What I claim, therefore, is, 1st, the heating chamber in front of the oven, in combination with the arrangement of direct and return flues at the bottom and back of the oven, substantially as described, for the purpose of imparting an equal, or nearly equal, heat to the oven, substantially as described.

"And 2d, I claim, in combination with the heating chamber in front, and the arrangement of direct and return flues at the bottom and back, substantially as described, the extension of the oven under the open hearth or apron of the stove, substantially as described, whereby the capacity of the oven is increased relatively to the other parts of the stove, and at the same time heated equally, or nearly so, as described."

Designs for August, 1850.

1. For a *Design for Cast Iron Brackets;* Walter Bryent, Boston, Massachusetts, August 13.

"My new design consists of the large Grecian scroll, terminating at each end in the volute, having a single leaf pendent from its centre, and an enriched double leaf pendent from its volute, said centre scroll being connected to the plates by the smaller Grecian scrolls, which are joined by the fluted ties, as shown in the drawings."

Claim.—"What I claim as my invention or production, is the combination of the central Grecian scroll, with its pendent leaves, with the several smaller Grecian scrolls and fluted ties, herein above enumerated and represented in the drawings; the whole forming a connexion between the vertical and horizontal plates of a cast iron bracket."

2. For a *Design for Coal Stoves;* John F. Rathbone, Albany, New York, August 13.

Claim.—"What I claim as my production, is the combination and arrangement of ornamental figures and forms represented in the accompanying drawings, forming together an ornamental design for a coal cylinder stove."

3. For a *Design for Stoves;* Billings P. Learned and Geo. H. Thatcher, assignees of Reuben J. Blanchard, Albany, New York, August 13.

Claim.—"What I claim as my invention, is the combination of leaves, vines, curves, and other ornaments, as represented in the annexed drawings and herein described, as a design for cast iron stove plates, making part of a cast iron stove."

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4. For a *Design for Stoves;* Sherman S. Jewett and F. H. Root, Buffalo, New York, August 27.

Claim.—"What we claim as our invention, is the shape and configuration of the ornamental plates for stoves herein described."

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5. For a *Design for Stoves;* Robert Donavan, Pittsburg, Pennsylvania, August 20.

Claim.—"What I claim as my invention, is the ornamental design for stove plates, as described."

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6. For a *Design for a Parlor Stove;* Johnson, Cox, & Co., assignees of George W. Ring, Troy, New York, August 27.

Claim.—"What I claim as new, is the design and configuration of ornamental stove plates. substantially the same as described."

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7. For a *Design for a Stove;* Spencer Cole and George C. Mosher, assignees of William L. Sanderson, Troy, New York, August 27.

Claim.—"What I claim as new, is the design and configuration of ornamented stove plates, substantially the same as described."

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8. For a *Design for Stoves;* Charles W. Warnick, Philadelphia, Pennsylvania, August 27.

Claim.—"Your petitioner claims to be the original inventor or producer of the design and ornamental part of said stove, as described."

SEPTEMBER.

1. For *Improvements in Sub-Marine Vessels;* Lambert Alexandre, France, September 3.

"My invention consists, 1st, in securing within the working chamber or cabin of the vessel a pump, which is connected by pipes with an air-tight compartment from which it can draw air, and into which it can compress air at will, the connexion being such that, by moving proper cocks or valves, the pump becomes either a suction or a force pump, with respect to the air-tight compartment, or to the cabin.

"My second improvement consists in attaching to each side of the sub-marine vessel a ballast platform, which is hinged at its inner edge to the vessel, and is slung at its outer edge by chains from rings, which are hung upon the end of a pin at the top of the vessel; the arrangement of the various parts of this device being such that, when the pin is pulled inwards by the occupants of the vessel, the rings are let go, and the platforms, being no longer supported at their outer edges, turn down upon the hinges at their inner edges, and discharge instantaneously any load placed upon them."

Claim.—"What I claim as my invention, is the method of effecting a circulation of the air, and of maintaining an atmosphere in the cabin of the requisite bulk to prevent the encroachment of water during the descent of the vessel, and of preventing the waste of air by its expansion and escape from the cabin during the ascent of the vessel, by pumping it either out of, or into, the cabin or air reservoir as may be required, even when the density of the atmosphere in the compartment whence the air is drawn is less than than that of the atmosphere in the compartment into which it is forced, as herein set forth.

"I also claim the device, consisting substantially of the drop-platforms, chains, and draw-pin, for the purpose of carrying ballast on the exterior of a sub-marine vessel, and of discharging it at will, as herein set forth."

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2. For an *Improved Method of Attaching Lines to Harpoons;* Charles F. Brown, Warren, Bristol county, Pennsylvania, September 3.

"The nature of my invention consists in an improvement in the mode of securing the line to the harpoon, by which the end of any line of suitable size and strength may be quickly secured without knots or splicing."

Claim.—"What I claim as new in my invention, is the manner of attaching and securing the line to the harpoon, by means of the ring sliding on the shank, and the rounded end of the socket or butt, in the manner substantially as herein described."

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3. For *Improvements in Machines for Dressing Staves;* Lewis S. Chichester, Troy, New York, September 3.

Claim.—"What I claim as my invention in the before-described machine for shaving staves from rived bolts, is the employment of two concave knives for shaving the outer or convex surface of the staves, substantially as described, in combination with a single knife for shaving the inner or concave surface of the staves, when the said single knife is placed in a line midway between the other two: that is, opposite the space between the other two, substantially in the manner and for the purpose specified."

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4. For an *Improvement in Pressing Cotton and other substances into Bales;* S. A. Clemens. Granby, Hartford county, Connecticut, September 3.

"The first part of my invention consists in packing the substances above enumerated, and all others of a like character, in a series of successive layers or strata, by the action of a roller or rollers, or cylinders, or curved or beveled faces on the surface thereof, the pressure being in succession applied to one or more of such layers or strata, whereby the substance or substances to be pressed and packed is more evenly distributed, and therefore in a condition to be condensed into a more compact mass, and with less power, for the reason that the power is divided and applied by the surface of the roller or rollers, or cylinders, or their equivalents, to a small portion of the surface of each layer or layers, instead of the whole mass at once.

"The second part of my invention, which relates to the means for applying the first part of my invention, consists in combining with rollers or cylinders, or their equivalents, for laying and compressing in successive layers or strata a bed which shall recede from the surface of the rollers or cylinders as the layers or strata accumulate, and which either traverses back and forth under them, or over which they traverse from end to end, to distribute the layers or strata.

"The third part of my invention consists in combining with a press for packing and pressing substances in successive layers or strata, by means of rollers or cylinders, or their equivalents, a lapping machine for laying or forming the fibrous substance or substances to be packed, into a lap or laps, preparatory to the operation of laying and pressing.

"The fourth part of my invention consists in combining with each of the laying and compressing rollers, or their equivalents, a series of rollers, or their equivalents, for retaining the layers in their compressed state as the bed traverses under them.

"The fifth part of my invention consists in making the bed of the press without sides or ends, to admit of the traversing motion for laying, and the depressing motion for yielding as the substance is packed, and to give free access to the ends and sides for baleing, in combination with a carriage which is provided with the requisite means for giving the required movements, the said carriage being provided with end plates to adjust the ends of the layers or strata as they are laid and pressed.

"And the last part of my invention consists in combining with the end plates attached to the carriage for adjusting the ends of the layers, a permanent plate at the outer end of each series of rollers, and a little below them, so located that the upper surface of the end adjusting plates, as they, with the carriage, shall pass under and in contact with them, to push into place any portion of the layers which may have been carried by the rollers on to the upper surface of the end plates."

Claim.—"What I claim as my invention, is the method of packing and compressing substances into bales or packages in a series of successive layers or strata, by means of rolling pressure or its equivalent, substantially as herein specified.

"I also claim combining with the laying and compressing rollers or cylinders, or their equivalents, a bed which shall be gradually separated from the rollers or cylinders as the layers or strata accumulate, and which shall also traverse from end to end under the rollers or cylinders, or *vice versâ*, substantially as specified.

"I also claim, in combination with the cylinders for packing and pressing substances in successive layers, a lapping apparatus for forming such substance or substances into a lap or laps, to be delivered to the rollers or cylinders, or their equivalents, to be laid and pressed into the bed, substantially as described.

"I also claim, in combination with the laying and compressing cylinders, or their equivalents, the series of rollers, or their equivalents, for retaining the layers or strata as they are successively compressed, substantially as specified.

"I also claim the bed made without sides or ends, substantially as and for the purpose specified, in combination with the carriage provided with adjusting plates at the ends, for the purpose and in the manner substantially as described.

"And finally I claim, in combination with the adjusting plates at the ends of the carriage, the stationary plates at the ends of the frame, under which the adjusting plates pass, to remove any substance that may have accumulated on them, substantially as described."

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5. For *Improvements in Repeating Fire Arms;* Samuel Colt, Hartford, Connecticut, September 3.

"My invention consists in making the central bore of the rotating chambered breech to extend from the rear part thereof to within a short distance of the front end, which is thus closed to prevent the entrance of smoke, when this is combined with the attachment of the barrel to the breech-piece or lock-plate, or both, independently of any connexion with the central pin or arbor on which the chambered breech rotates."

Claim.—"What I claim as my invention, is making the central bore of the many-chambered rotating breech, which fits and turns on a central pin or arbor, to extend from the rear part thereof to within some distance from the front end, and thus leave the front end closed, substantially as described, to prevent the access of smoke, when this is combined with the connecting of the barrel with the shield-piece and lock-plate, substantially as described."

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6. For an *Improvement in Hand Spinners;* David Current, Crittenden, Kenton county, Kentucky, September 3.

"The nature of my invention and improvement consists in arranging on rails secured to the upper surface of a suitable platform, a traversing carriage on which a spindle is suspended, and causing said carriage to be moved back and forth by means of bands passing over wheels and pulleys, without requiring the operator to move from one position; and also in providing the apparatus with a clamp lever for giving a backward motion to the spindle in case the thread becomes too taut, to prevent breakage."

Claim.—"What I claim as my invention, is the combination of the clamp lever with the cords and drum, for the purpose and in the manner substantially as described."

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7. For a *Machine for Beveling the Surfaces of Washers, &c.;* William Field, Providence, Rhode Island, September 3.

"The principle or character of the first part of my invention consists in drawing out and giving the bevel form to metal clinch rings, &c., by the action of the surfaces of traveling rollers turning on bearings arranged about a common centre of rotation, that the surface of the said rollers may in succession be made to pass over the surface of a piece of metal, and thus draw out or give it the form required, as a substitute for the action of a hammer, when this is combined with a spindle or mandril, to which are fitted the holes in the clinch rings or washers to be operated on; the said spindle being provided with the necessary means for turning it, that the clinch ring or other article, when put thereon, may be turned to present in succession every part of the circle to the action of the rollers.

"The second part of my invention consists in combining with the spindle, for presenting the ring to the action of the rollers, a gripe for griping and holding the ring or washer into the spindle whilst being acted upon."

Claim.—"What I claim as my invention, is the method substantially as herein described, of drawing out and giving a bevel form to metal clinch rings, washers, &c., by the action thereon of the surfaces of a series of traveling rollers, turning on bearings arranged about a common centre of rotation, and combined with a spindle or mandril adapted to the reception of the clinch rings or washers to be formed, and provided with the means, substantially as herein described, for turning it, to present in succession every part of the periphery to the action of the rollers, substantially as described.

"I also claim, in combination with the spindle or mandril for presenting the clinch rings or washers to the action of the traveling rollers, a gripe, substantially as described, for griping and holding the said rings or washers on to the spindle or mandril, whilst passing under the action of the traveling rollers as described."

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8. For an *Improvement in Draining Sugars;* Conrad William Finzel, Bristol, England, September 3; anté dated October 12, 1849.

"My invention consists in a mode of applying steam or liquids to machines used for separating fluids from sugar by means of centrifugal force, for the purpose of clearing, and keeping clear, the meshes or apertures in the periphery of the revolving cylinders of such machines."

Claim.—"I claim as of my invention, the mode of applying steam or liquids to machines used for separating syrups or fluids from sugar by means of centrifugal force, for the purpose of clearing, and keeping clear, the meshes or apertures in the periphery of the revolving cylinders of such machines, in manner herein described."

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9. For an *Improvement in Clamps for Holding Paper and Drawing;* Eliakim B. Forbush, Buffalo, New York, September 3.

"The nature of my invention consists in making an apparatus to attach to a thin board, desk, table, or other place, for the purpose of holding paper or other material firm and smooth in the position in which it is placed for writing, drawing, coloring, or other purpose."

Claim.—"What I claim as my invention, is the clamping slides made to slide freely on the parallel rods, operated by the lever and the springs, substantially in the manner and for the purpose as herein set forth."

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10. For an *Improvement in Fastenings for Hay Rakes;* Orange W. Hogle, Somerset, Niagara county, New York, September 3.

"My improvements relate particularly to the manner of constructing the wooden cymareversa teeth of the rake, and the manner of holding them during the operation of raking, and the manner of revolving them whilst discharging the hay into a window; the formation and arrangement of said teeth and other parts of the machine being such as to render the rake the lightest, cheapest, and most symmetrical rake of all the revolving horse hay rakes now in use."

Claim.—"What I claim is, 1st, the manner of holding the teeth firmly in their required positions against the sliding bar during the operation of the machine, by means of the aforesaid combination of the ratchet wheel, pawl, sliding bar and stem, helical spring *n*, fixed bar, and slide attached thereto, with the parallel guiding arms and revolving finger shaft, arranged and operating in the manner and for the purpose above set forth.

"2d, I likewise claim the combination of the slide, helical spring *g*, strap, and roller, with the parallel arms and fixed bar, for disengaging the sliding stop bar from the rake teeth without moving the hand from its usual position on the hand roller, to allow the teeth to revolve to deposit the hay in windrows, as set forth."

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11. For an *Improvement in Stoves;* Sherman S. Jewett and Francis H. Root, Buffalo, New York, Septemper 3.

"Our improvement consists in constructing the front or end plates of stoves or grates with recesses in their jambs, closed in front by doors; these recesses are of sufficient capacity to receive the doors of the fire place, which, when opened, are turned back into them, and are concealed from view by shutting the doors of the recesses."

Claim.—"What we claim as our invention, are the jambs of stove or grate fronts or ends constructed with recesses closed by doors, within which the doors of the fire place are folded up and concealed from view; the fire place doors being constructed and arranged to turn back into the recesses, substantially as described."

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12. For an *Improvement in Car Couplings;* David S. Neal, Lynn, Essex county, Massachusetts, September 3.

Claim.—"What I claim as my invention, is the bearing roller or rollers placed within the body of the coupling, and the bearing roller located in one end of the connecting link, for the purpose of enabling the connecting bolt to be easily detached from the link when the cars are in motion; when this arrangement of the said rollers and connecting bolt is combined with the loop, the catch-head, and cord, for uncoupling, in such a manner that the loop will be disengaged when force is applied to withdraw the bolt, but will prevent the connecting bolt from being accidentally thrown out of place when the cars are in motion."

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13. For an *Improvement in Planing Machines;* J. F. Ostrander, City of New York, September 3.

"The nature of my invention consists in the peculiar construction of the cutter or planer, and its combination with a reciprocating frame, and compressor spring for holding the face of the plank or other material from splitting or lifting while under the edge of the cutter, when in motion; and the combining and adapting the same with feed rollers, tonguers, and groovers, and driving power, for the purpose of planing, tonguing, and grooving plank and other substances."

Claim.—"What I claim is, 1st, the use and employment of the cutter, made and fashioned in form and manner described, or any analogous form and manner, whereby the peculiar cutting, beveled, scolloped edge is attained, for planing or dressing plank or other material, substantially as set forth.

"2d, I also claim the use and employment of the cutter, in combination with the compression spring feed rollers and straight edge, or any one or more of them, in form and manner and for the purposes substantially as set forth."

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14. For *Improvements in Sewing Machines;* Philip May, London, England, assignee of Barthelemy Thimonnier, Sr., Amplepius, Department du Rhone, France, September 3; anté dated February 9, 1849.

"This machine mainly consists of so constructing the parts and combining them, that the fabric or fabrics are to be supported on a surface through which (and opposite to the hook used to produce and draw through the stitches) there is a hole, so that the hook employed, having passed through one or more thickness or thicknesses of fabric, it will pass through such hole, and when beyond the plate or surface, a thread of silk, cotton, or other material, will be caused to be laid partly round the stem of the hook, in such manner that the hook, in passing through the fabric or fabrics, will carry with it a loop of such thread, there being a tube or instrument retaining down the fabric or fabrics till the hook has passed back. The fabric or fabrics are then to be moved a distance equal to the length of the stitch, the hook is again caused to pass through the fabrics, and the holding down instrument holds the fabric, and the thread is again wrapped partly round the stem of the hook, which, in again going back through the fabric or fabrics, draws the new loop through the one or more thicknesses of fabric, and also through the previous loop, the work produced being what is called tambour stitch; and it is combining the use of a hook with a perforated surface, against or on which the fabric is held by a tube, (or other holder acting in like manner,) acting with a thread carrier which partly rotates, which constitutes the peculiar character of this invention over those machines and apparatus before made, where tambour hooks have been used.

Claim.—"What I claim is the hook, the surface, the tube or holder, and thread carrier, working substantially as above described."

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15. For *Improvements in the Direct Action Steam Hammer;* Samuel V. Merrick, assignee of John H. Towne, Philadelphia, Pennsylvania, September 3.

"My invention is an improvement on the steam hammer of James Nasmyth of Great Britain. In the steam hammer invented by James Nasmyth, as aforesaid, the hammer is operated by, and is attached to, the piston rod of the steam piston, a spring being interposed between the said hammer and piston rod, to prevent as much as possible the upsetting of the said piston rod by the percussive action of the hammer.

"The object of my invention is to avoid the difficulty and inconvenience of interposing such spring, or the very injurious effects of the percussion, when the hammer is attached to the piston rod, without the interposition of a spring. To this end, the nature of my invention consists in combining the hammer with the movable cylinder, the steam being admitted and discharged to and from the movable sliding steam cylinder."

Claim.—"What I claim as my invention, is attaching the hammer to the sliding steam cylinder, substantially as herein described, the steam being admitted and discharged to and from the sliding steam cylinder, substantially as herein described."

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16. For *Improvements in the Manufacture of Lead Pipe;* William P. Tatham, Philadelphia, Pennsylvania, September 3.

Claim.—"What I claim as my invention, is the method substantially as described, of setting or cooling the inside of the mass of metal within and throughout the length of the cylinder, and before or preparatory to pressing out the pipe, by passing a cooling fluid into or through a long core or core-holder extending through the length of the cylinder, as described, the said method having the effect at the same time to keep the said core or core-holder cool and stiff, as described."

17. For an *Improvement in Apparatus for Breaking Horses;* Seymour Tomlinson, Washington Hollow, Dutchess county, New York, September 3.

"The nature of my invention consists in the method of breaking and controling a horse, by harnessing him to a pair of shafts connected together at their front ends by means of a bow which passes around in front of the horse's breast, the harness consisting of two straps, one passing from the bow over the horse's crest, and the other from the shafts under the horse's breast, and back of the front legs."

Claim.—"What I claim as my invention, is the method substantially as herein described, of breaking horses by means of the shafts which are connected together by a bow passing around in front of the horse's breast, substantially as herein described, in combination with the two straps, one passing over the crest and the other under the breast, by which the horse is harnessed to the said shafts, substantially as described."

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18. For an *Improvement in Surgeons' Splints;* Benj. Welch, Lakeville, Litchfield county, Connecticut, September 3.

"The nature of my invention consists in the formation of the aforesaid splints by the combination of very thin boards, by means of some elastic adhesive substance interposed between them."

Claim.—"What I claim as my invention, is my improved surgeons' splint, composed of thin strata of wood combined with some elastic adhesive substance interposed between them, substantially as herein set forth."

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19. For an *Improvement in Ladies' Stays;* Louisia Balis, Oriskang, Oneida county, New York, September 10.

"My invention consists in a proper distribution of the support, likewise protection given to the body by a new arrangement of the position, length, and shape of the lower gores; also a new construction of the shoulder strap, by means of which the chest can be expanded in a proper and effectual manner."

Claim.—"What I claim as my invention, is the peculiar arrangement (in the body of the stay) of the whale-bones, in combination with the gores of the peculiar form, and in the particular position, represented, whereby the usual irritating effects of ladies garments upon the muscles, &c., about the loins are avoided, at the same time that effectual support is given to the whole waist, by means of the peculiar position and shape of the gores, and then the easy curves given to the whale-bones, as set forth."

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20. For an *Improved Mode of Representing Musical Scales;* W. B. Billings, Eastport, Washington county, Maine, September 10.

"The nature of my invention consists of a frame of wood carrying a board representing the ground-work of the scales; at each side of the board are placed movable bars of metal or wood, each provided with corresponding series of holes which receive the ends of the cross-bars or wires, the holes in the side bars being so arranged that, by means of the required number of cross-bars, and a movable centre piece, all the major or diatonic scales and their relative minor scales, the chromatic scale, and the enharmonic scale, may be represented, a letter being attached to each bar to indicate what sound it represents. Attached to one side of the frame is a board having staves marked upon it, to assist in explaining the necessary exercises."

Claim.—"I claim the manner herein described, of representing each and all of the scales used in music, by the combination of the board, the side bars *c c*, the centre piece, and the bars *d d d*, and *d' d' d'*, having letters attached to them to indicate the name of the notes they represent, or any other combination of parts substantially the same."

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21. For *Improvements in Revolving Chambered Fire Arms;* Samuel Colt, Hartford, Connecticut, September 10.

The first part of my invention relates to the method of insuring the true and accurate position of the breech at the end of each shift of the chambers, preparatory to the discharge, and consists in combining with the holes which receive the end of the locking bolt, elongated grooves of less depth, and extending from one hole towards the next throughout the series, so that the end of the locking bolt, which enters by a spring and is withdrawn by the lock, shall enter the elongated grooves, and be within the surface of the rotating breech, before the chamber is brought to the line of the barrel, and thus be in a position to insure the stoppage of the breech when it reaches the line of the barrel, and then enter the locking hole before it can rebound or turn back. By this means the arm can be operated with the utmost rapidity without any danger of having the barrel out of its true line at the time of the discharge.

"And the second part of my invention, which relates to the manner of locking the breech when the arm is at rest, to prevent accidental discharges, consists in locking or holding the rotating breech midway, or nearly so, between any two of the chambers, by a hole in the face of the cock or hammer fitting on to a projection of the rotating breech, or *vice versâ*. By this means, if the cock or hammer be struck when the arm is at rest, no explosion can take place, as the hammer in that position is not in contact with either of the nipples, which with the breech so situated, are effectually protected by the shield plate."

Claim.—"What I claim as my invention, and as an improvement for fire arms having a rotating breech with a series of parallel chambers, is, in combination with the locking holes of rotating chambered breech fire arms, substantially such as herein specified, making grooves leading to each locking hole, substantially in the manner and for the purpose specified, when this is combined with a bolt independent of the mechanism which rotates the breech, and which bolt enters to lock by a spring, and is withdrawn by its connexion with the lock, substantially as described.

"And I also claim holding the rotating breech midway, or nearly so, between any two of the chambers, to prevent accidental discharges, by means of a recess or hole in the hammer or cock, fitting on to a projection of the rotating breech between any two of the chambers, or *vice versâ*; substantially as herein specified."

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22. For an *Improvement in Paint Mills;* W. W. Draper, Greenfield, Franklin county, Massachusetts, September 10.

"The nature of my invention consists in the shape of the grinding face given to the muller, when it is combined with the smooth face of the bed, viz., the face of the muller having broad depressions formed in it, extending from near its centre to within a short distance of its periphery, and a corresponding number of narrow discharging grooves that extend to the periphery of the same, one of which grooves is located immediately in front of each of the depressions; the object of the depressions in the muller being to keep a large body of paint in contact with the face of the bed, and gradually distribute it between the grinding faces of the bed and muller, while they at the same time prevent the escape of the paint therefrom before it is thoroughly levigated; the said grooves serving to collect the levigated paint after is passage over the smooth surface of the muller face, between the rear edge of the depressions and the grooves, and discharge the same at the periphery of the muller."

Claim.—"What I claim as my invention, is the broad depressions in the face of the muller, when combined with the discharging grooves in the same, and with the plane surface of the bed, substantially in the manner and for the purpose as herein set forth."

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23. For an *Improvement in Picking Cotton from the Bolls in the Field;* Samuel S. Rembert and Jedediah Prescott, Memphis, Tennessee, September 10.

Claim.—"What we claim as our invention, is, 1st, the combination of the whipping cylinder with the picking disks and the strippers B B; and also the combination of the whipping cylinder with the picking cylinders and the strippers D D, substantially in the manner and for the purpose set forth.

"2d, We claim the combination of the picking disks and the strippers B B, with the gathering planes and the cotton receptacle, substantially in the manner and for the purpose set forth.

"3d, We claim the combination of the picking cylinders and the strippers D D, with the gathering planes and the cotton receptacles, substantially in the manner and for the purpose set forth."

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24. For an *Improvement in Smiths' Strikers;* Melchi Scott, Claysville, Washington county, Pennsylvania, September 10.

Claim.—"What I claim as my invention, is attaching the raising and rebound springs, and the hammer, to the same adjustable frame, substantially as described, when this is combined with the adjustable attachment between the hammer and the treadle, whereby the hammer can readily be adjusted to strike a flat blow on iron of different thickness."

25. For an *Improvement in Camp Bedsteads;* William C. Shaw, Philadelphia, Pennsylvania, and James Stalcup, Wilmington, Delaware, September 10.

Claim.—"What we claim as new, is, 1st, so arranging the parts of a camp chest that, when it is unfolded in a direction parallel with its length, it will constitute a bedstead which may be of the width of the inside of the chest, and when unfolded in a direction at right angles with its length, it will constitute a bedstead which may be of the width of the inside of the length of the chest.

"And 2d, The arrangement by which a part of the front of the chest can be used as a table-leaf, and the slides as seats at the table, substantially in the manner and for the purpose set forth."

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26. For *Improved Exhaust Passages for Steam Cylinders;* George Shield, Cincinnati, Ohio, September 10.

Claim.—"What I claim as new is the twofold outlet or steam passage from the cylinder into the exhaust valve chamber, which admits the steam above and below, and discharges it between the disks of the exhaust balance valve, and thus facilitates the insertion, withdrawal, and adaptation to the exhaust side in the line of its stem, or spindle of a balance valve, whose disks are cast in one piece, and are held down to their seats by the stress of steam."

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27. For an *Improvement in Mortising Machines;* Smith Spencer, Angelica, Alleghany county, New York, September 10.

Claim.—"What I claim as new, is, in combination with a device for giving the chisel a reciprocating motion, the device for giving it at the same time an oscillating motion, substantially as set forth."

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28. For an *Improvement in Machines for Scribing Lumber;* John Shellenberger, Indianopolis, Morrison county, Indiana, September 10.

"The nature of my invention consists in a frame provided with suitable rests and stops, upon and between which I place the stuff in which I desire to mark out and scribe the mortises and tenons. Two sliding carriages provided with cutters or gauges, one moving vertically and the other horizontally, are operated by suitable mechanism for scribing the sides and edges of the stuff. The cutters being set in any required position will scribe any number of pieces. A cutter or gauge is also placed in one of the sliding carriages, which, on the carriage being fixed, may be operated in a diagonal direction, for the purpose of scribing bevel mortises."

Claim.—"I claim the manner of operating the horizontal sliding carriage carrying the cutter blocks F F, and the cutters *f f*, and the vertical sliding carriage carrying the cutter blocks F^2 F^2, and the cutters or scribers f^2 f^2, in such manner that they perform the duties in concert without interferring with each other, by means of the levers G G, the rods *h h*, the levers *a a*, the straps *c e*, the levers *i j i j*, and weights *k k*, in combination with the pulleys, the straps J J, the rods *l l*, the levers K K^2, and the weights L L^1; the levers G G, and the pulleys, being hung up on the same shaft, and operated by the same treadle, substantially in the manner and for the purposes described."

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29. For an *Improvement in Clover Hullers;* Robert Stadden, Milton, Northumberland county, Pennsylvania, September 10.

Claim.—"What I claim as new, is the continuous wave-form of the rubbers of the concave; and I further claim the continuous wave-form of the rubbers if it should be applied to the cylinder instead of the concave."

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30. For an *Improvement in Plough Clevises;* John B. Stoner, Southampton, Cumberland county, Pennsylvania, September 10.

Claim.—"What I claim as new, is forming a plough clevis by means of two arcs of metal of corresponding outward curvatures, having the point of attachment of the draft link to the martingale for their common centre of curvature, in the manner and for the purpose set forth."

"2d, I also claim, in combination with a fixed horizontal arc, having a slot between bearing edges, the vertical arc having notches on its inner curve adapted to the bearing edges of the fixed arc, whereby the direction of draft may be varied horizontally or vertically, as required."

31. For an *Improvement in Friction Rollers;* Joseph M. Totten, Peoria, Peoria county, Illinois, September 10.

Claim.—"What I claim as my invention, is the friction rollers, each composed of a series of separate sections, held together by nuts or otherwise on a common spindle, in such manner that the spindle and roller sections usually turn together, but when any obstruction intervenes to stop the movement of any one section, and thus cause it to grind and flatten, the adjacent sections, with the spindle, continue to roll on, and, by rubbing against the obstructed one, tend to move it past the obstruction, thereby preventing continued excessive wear on any one portion of its periphery; hence the irregular wear of any one of the sections will not affect the general roundness of the whole to such a degree as will materially impair the efficiency of this device as an anti-friction roller."

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32. For an *Improvement in Plough Cleaners;* David Warren, Gettysburgh, Adams county, Pennsylvania, September 10.

"The nature of my improvement consists in combining with any common plough a vibrating finger clearer, arranged in such a manner in relation to the throat or sheath of the plough, that by the simple use of the hand of the ploughman to elevate and depress a lever, a series of fingers will be made to vibrate back and forth adjacent to the sheath, and clear away straw, stubble, or other obstructions which may accumulate around the sheath of the plough while it is ploughing, thus dispensing with the necessity of stopping the team to relieve the plough."

Claim.—"What I claim as my invention, is the combination of the vibrating finger clearer with the beam and sheath of the plough; said finger clearer being arranged in such a manner in relation to the sheath or throat of the plough, that, by the use of the hand of the ploughman to elevate and depress a lever, a series of curved or straight fingers will be made to vibrate back and forth adjacent to the sheath, and clear away straw, stubble, and other obstructions therefrom, as described."

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33. For an *Improvement in Tailors' Measures;* William W. Allen, Bordentown, Burlington county, New Jersey, September 10.

Claim.—"What I claim as my invention, is the use of the slides for laying off the division of the several measures for a coat, in combination with the fashion slides, for the purpose and in the manner set forth."

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34. For an *Improvement in the Seeding Roller of a Seed Planter;* Aaron Palmer, Brockport, Monroe county, New York, September 10.

Claim.—"What I claim as my invention, is the constructing a seeding wheel for a planting machine by the combination of the two parts of the form described, in such a manner that, by turning one of the said parts within or upon the other in one direction, the planting receptacles will be reduced in depth and size, and, by turning the said part of the seeding wheel in an opposite direction, the planting receptacles will be enlarged in depth and size, substantially as herein set forth."

MECHANICS, PHYSICS, AND CHEMISTRY.

Report upon the Telegraphic Apparatus of M. Siemens, *of Berlin, presented to the Academy of Sciences, Paris.*[*]

Continued from page 212.

M. Siemens has effected a most important advantage in the arrangement of alphabetic telegraphs, by means of which the party receiving the message can, at the same time, communicate with the other party without having recourse to a second wire, or in any way disturbing the arrangement of the apparatus or interrupting the delivery of the message. For the purpose of enabling a party, while receiving a message, to communicate with the party sending it, in order to correct an error or have an imperfectly understood signal repeated, &c., M. Siemens entirely dispenses with the interrupter, and arranges his dial apparatus in such manner that it shall act precisely in the same manner, whether sending or receiving a message.

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[*] From the London Journal of Arts, Sciences, and Manufactures, Vol. xxxvi., 1850.

We will endeavor to give an intelligible description of this ingenious apparatus, which acts with great speed and perfect regularity. The armature of the electro-magnet is provided with a lever, about an inch in length, which produces two very different actions. The effect of the first is, at every double vibration, (backwards and forwards,) to drive forward the wheel, which is mounted upon the shaft of the needle or indicator, the distance of one tooth, and, consequently, carries the needle forward a letter. By the second action it breaks the circuit and stops the current from which it has itself received its motion; but not until it is itself stopped in its forward motion, *i. e.*, when the armature, attracted by the electro-magnet, has approached as near the poles as possible: the circuit being then broken, the armature ceases to be attracted, and being immediately drawn back by its spring, the lever returns to its former position. By this means the circuit is again completed, and the current re-established; and the lever is immediately carried forward again by the armature, to return again as before. These isochronal vibrations would proceed for an indefinite period, as long as the battery furnished a current of equal intensity; but they would become slower as its power diminished, and finally cease when the action of the current became too weak to endue the temporary magnet with power sufficient to overcome the inertia of the armature, and the tension of the spring which holds it back from the poles.[*]

Two similar apparatus of this kind introduced into the circuit, one at Berlin and the other at Paris, would work with perfect synchronism, (excepting the speed of the electricity, which need not be taken into account;) and if they were in accord at the commencement, *i. e.*, if the needles corresponded with the same sign, they would make thousands of revolutions, and would work for days and even years in concert; that is, they would always at the same instant be opposite similar signs: this apparatus derives its motion entirely from the battery. The indicating needle would, however, have a regular movement, like that of the second-hand of a watch, but it would be more rapid, as it might be made to move an entire revolution in a second, taking only the thirtieth part of a second to travel from one sign to another,—supposing the lever of the armature to make thirty double vibrations per second. M. Siemens has, however, only tried his apparatus at one-half this speed, viz., a revolution every two seconds, or a double vibration of the lever of the armature every fifteenth part of a second. This does not imply that his needle will indicate fifteen signs per second, or nine hundred per minute, for the eye could scarcely follow the needle; besides, with this regular and uniform jerking motion, it shews all the signs equally, and produces the same effect as if it indicated none, as the observer cannot distinguish anything or follow its movements. The same effect is produced as if a person were to recite the alphabet several times over in a perfectly monotonous tone, without laying emphasis upon any particular letter;—it would be utterly impossible to distinguish what he had been saying.

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[*] In 1843, M. de la Rive augmented the chemical action of a simple element by introducing into the circuit an electro-magnet, the armature of which, by its slow vibrations, effected successive ruptures. In 1846, M. Froment, applying the same principle under another form, caused the armature of an electro-magnet to vibrate with sufficient velocity to produce very sharp sounds. (*Comptes Rendus*, *Vol.* xxiv., *p.* 428.) At the same period M. Froment employed these vibrations as a motive power, after having added to his apparatus a mechanical arrangement capable of being regulated at pleasure, and which broke the circuit at any required period.

Something still remained, therefore, to be added to the above apparatus; the needle must be stopped in its course, not for a long time, but during half a second, or perhaps only a third or a quarter of a second, according to the quickness of the movements of the parties sending and receiving the message: by this means the needle would point out the letter to which it is required to direct attention. To obtain this result, M. Siemens has placed around his dial as many stops as there are signs, and upon each stop the sign to which it belongs is legibly marked. On pressing the finger upon any one of these stops, a small vertical rod of one or two-thirtieths of an inch in diameter is depressed, which rod acts as a stop to a horizontal lever parallel to the needle and mounted on its axis. This has exactly the same effect as if the needle itself were stopped, but the mechanism is hidden under the dial, in order not to distract the attention of the operator. It is not sufficient for the needle to be stopped exactly opposite the sign it is intended to indicate; it is important that the motive lever affixed to the armature, the vibration of which is arrested by the same obstacle, should then be midway in its return motion, which is caused by the action of the spring.

The person sending a message has, therefore, only one operation to perform, viz., to lay his finger successively upon the stops corresponding to the signs he is desirous of transmitting, and when the needle comes round to the sign, (the stop of which is depressed,) it will stop. The needle at the other station, although its motion is synchronical, will not stop at precisely the same instant, as the lever which moves it, being also drawn back by its spring, is obliged to return,—as it does not, like the other one, meet with any bodily obstacle to its progress; it therefore completes its return motion, and assumes the position required for completing the circuit and re-establishing the current. This, however, cannot take place immediately, as the needle at the other station is retained in a position in which it breaks the circuit. Thus the operator who is sending the message, by placing his finger upon a stop for a fraction of a second, gives a sudden check to the movement of the needle at the other station; but it must be remarked that the two needles cannot stop at the same instant, the second is not arrested until the expiration of about a quarter the duration of a complete duration. This circumstance is important, from the influence it exerts upon the number of signs which may be transmitted in a given time.

Upon the person who sends the message raising his finger from the first stop, in order to act upon another, the following actions will take place: The lever of his apparatus, obeying the action of its spring, is free to complete its return motion, which it does. The circuit being thus completed the current will be re-established; the armatures of the two stations are simultaneously attracted, and the needles resume their progress until the next stop is depressed; this will act on the needle of the other station, and the action will be repeated as before. The person receiving the message has only attentively to follow the movements of his needle, and write down or dictate the signs which its indicates; but if he is in doubt or difficulty, he lays his finger upon a stop, and thereby arrests the movement of the needle at the other station; he will thus be enabled to communicate with the other party and clear up the difficulty, after which the transmission of the message may be resumed. It will be understood that by this apparatus the communication will assume the nature of a verbal conversation, in which each party can put in his word.

The apparatus of which an idea is given above does not require any auxiliary; but in that case reliance must be placed upon the correctness of the party receiving the message. To provide, however, against the effects of negligence, M. Siemens has arranged a magnetic printing apparatus, by means of which the message may be as well printed as by a press. When this is used the person receiving the message has nothing to do while his apparatus is at work, but at the end of the operation he will find a strip of paper upon which the letters of the message are accurately printed, with a larger space between the words than the letters. It might even be correctly punctuated to render the text intelligible, but for ordinary communications this will be quite unnecessary.

The printing apparatus, which is at once ingenious and effective, is constructed in the following manner:—A vertical shaft precisely similar to the shaft carrying the needle, and receiving rotary motion by means of precisely similar mechanism, carries at its upper part thirty horizontal radiating arms, set in the same plane at equal distances apart, and on each of these arms, near the end furthest from their axis, at their upper part, is a letter in relief. These arms are flexible, and as they act in the same manner as springs, it will be sufficient to drive them upwards against the fillet of paper a little above them, and make them press against it with a suitable amount of force. This fillet of paper passes round about half the circumference of a printing roller provided with printing ink, which is only communicated to the paper at those parts where the arms carrying the types are made to strike, at which parts the letters will be clearly printed.

There are, however, peculiar arrangements of mechanism for the purpose of fulfilling the two following conditions, viz., 1st, To enable the printing roller (which must be stationary at the moment of printing) to turn and carry the paper round a suitable distance, for the purpose of producing a blank space as soon as it has received a letter, and a larger space when a word is completed. 2d, To enable the hammer which strikes the letter underneath to do so at the precise moment when this latter stops to receive the blow.

It has already been said that the arms which carry the letters in relief receive motion in the same manner as the needle, *i. e.*, they themselves form a kind of revolving dial; so that all the letters come in succession under the hammer, which is a fixture. The party also who sends the message can, by pressing upon a stop, arrest for an instant a type at the other station in the same manner as he stops the dial needle at any particular letter.

It now remains to explain how the hammer is caused to act during that instant. This is effected by means of a powerful electro-magnet, worked by a separate battery, the current of which is, of course, distinct from that of the telegraphic circuit. Each time that the motive lever of the telegraph performs a vibration and passes a type, it establishes a communication between the poles of the auxiliary battery, or, in other words, it completes the circuit of the printing electro-magnet;—this latter, however, does not act immediately, as it is constructed so as to be affected more slowly by its current; but, when the motive lever stops for an instant under the action of its spring,—that is to say, at the limit of its return, in order to repeat the sign which the other station had transmitted,—the printing electro-magnet receives from the current which passes through it sufficient power to actuate the heavy armature. By this movement it produces the following effects:—1st. By means of a long lever attached to it, the hammer is caused to strike the type or letter. 2d. By a second lever, which acts a little later on a ratchet-wheel, the printing roller, with its fillet of paper, is turned the extent of one ratchet-tooth: this roller has also a longitudinal movement, in order to enable the whole surface of the paper to be printed upon. 3d, By means of a third lever, the circuit of the auxiliary battery is broken; and thus the power which actuated it is destroyed, and the lever is instantaneously drawn back by its spring. 4th. By means of a fourth lever, which only acts at the completion of each word, the armature of the printing electro-magnet strikes a bell, and thereby signals to the parties at the opposite stations whether their apparatus agree. This action is effected by an ingenious arrangement:—each word is terminated by a blank stop; and the arm corresponding to that stop has no letter upon it; the hammer, therefore, on striking, not meeting with any resistance from a letter in relief, make a rather longer stroke, and allows the armature, to which it is attached, also to proceed further. By this means, the bell is struck by the fourth lever at the end of each word only,—it being silent while the letters are being printed.

M. Siemens has also adapted an apparatus which he calls a *transmitter*, which is only intended to transmit messages between two very distant stations. This apparatus is on the same principle as the above; but, besides this, it presents an interesting application of the theory of derived currents. The current which circulates between the stations (properly called the telegraphic current) may be very weak, as scarcely any effort is required of it;—its only function being to open and close the circuit at the proper time. The currents from the batteries of the respective stations, then passing almost exclusively into the signal apparatus, will possess sufficient power to work them; and, when their office has ceased, the weak telegraphic current will act in its turn to prepare the apparatus for the next signal.

The Commission have examined M. Siemens' apparatus with great interest, and remarked throughout an evidence of a perfect intelligence of the theory, as M. Siemens appears to have taken into account all the complicated phenomena which are manifested in the conductors and electro-magnets, especially when the actions are of short duration.

M. Siemens' system, if worked with care and attention, appears to possess incontestible superiority over all other apparatus of the like nature,—that is to say, the ordinary arrangements of alphabetic apparatus; as the latter do not work with the same degree of precision and accuracy. With regard to speed, the Commission are led to believe that M. Siemens' apparatus surpasses all other alphabetic apparatus; their opinion is also that M. Siemens' improvements in the construction of electro-magnets will prove advantageous,—more especially if care be taken to associate two magnets of equal power.

For the Journal of the Franklin Institute.

Paddle Wheels for Marine Steamers.

In a paper published in the last two numbers of this Journal, upon the comparative merits of the "Perpendicular" and "Radiating" paddle wheel for marine steamers, Mr. Isherwood, of the U. S. Navy, has undertaken to prove the superiority of the former kind, known as "Morgan's Vertical Wheel," adducing in support of his position the case of two English war steamers, fitted respectively with either.

We confess that, notwithstanding the apparent correspondence existing between his theory, data, and calculations, we are not fully satisfied of the propriety of adjudging a question so important to the economy of a steam marine upon grounds which a little examination will show to be entirely unsubstantial.

So much has already been written upon the subject, theoretically considered, that it is evident the author must, in support of his opinions, depend mainly on the character of results attained in practice, of which he gives an example; it is principally with his data, therefore, that we have to do at present.

In the example before us, the steamers are of 600 and 900 tons, and are respectively named the "Black Eagle" and "Trident," the first fitted with Morgan's, the latter with the ordinary wheel. The "Black Eagle" has two engines, with cylinders 62 inches by $4\frac{1}{2}$ feet stroke; the "Trident," two, with cylinders $70\frac{3}{4}$ inches by 5 feet stroke; wheels about the same size (effective diameter) in both, but the area of a single paddle in the *smaller* vessel is 1·27 times that of the *larger*,—a fact which will partially account for the very unusual circumstance of greater slip being found with the ordinary than with Morgan's wheel, at light immersions. The mean average pressure of steam is said to be the same, but is evidently not given by an indicator diagram, or if it *is*, that authority should have been furnished, because every engineer knows that to be the only reliable source for the datum in question; and the most important circumstance of all, viz., the consumption of fuel, is entirely neglected. Under these circumstances, the vessels are respectively found to attain speeds of 13·14 and 11·92 statute miles per hour; and Mr. I. thence infers, after entering into a *lengthy* calculation of powers and effects, that the Morgan wheel is "better in the proportion of 1·000 to 0·9055" than the radial wheel.

It will be observed that, at the times of the experiment, the two wheels are at very different dip; that while the *Morgan* is immersed about 0·25 of its diameter, the other has a dip of only 0·10 of its diameter, which is less than one-half of the usual mean immersion.

Now it has been shown, by experiments made some years ago at Maudslay & Fields' Works, London, (for an account of which see the paper of Mr. P. W. Barlow, *Tredgold's 1st Appendix*, pp. 54 to 56,) that, while a Morgan wheel, immersed to one-fourth (·254) its diameter, would overcome a resistance of 8175, (found by multiplying the square of its velocity by the weight employed in moving the wheel,) a radial wheel, with an immersion of one-tenth (·104) its diameter, overcame 9095; or, in other words, that the effects produced were as 8175 to 9095, or as 9 to 10 nearly; a result which appears to be precisely the reverse of that obtained by Mr. I. What then is the cause of the discrepancy? A reference to the table of experiments will show that the effect produced by the radial wheel goes on increasing till immersed to 0·22 its diameter; therefore the error cannot be in the small dip of the "Trident's" wheel. These experiments, it may be remarked, were made with great care, with a wheel of nearly 18 feet diameter; and although it is acknowledged that the friction of the Morgan gearing was proportionably greater than it would have been in a larger wheel, yet as the model was put together with greater care, the error from this source can be but trifling. Since, then, the discrepancy does not appear to be in these experiments, let us examine the data of Mr. I.'s paper.

The first thing that strikes us in the comparison, is the *utter* incongruity of the two examples given;—if the author had searched the whole English navy, he could scarcely have found two more unlike in every respect than those selected. One is 155 feet long, by 26 feet beam; the other 195 feet by 31. One is 6 to 1 of length to beam; the other $6\frac{1}{2}$ to 1; the tonnage of the first, therefore, is $495\frac{92}{95}$, and of the latter $860\frac{92}{95}$, U. S. measurement. One has but two-thirds the displacement of the other according to the data, and so far from there being any similarity of model, the reverse is highly probable, since the English Government is not in the habit of following any fixed rules with regard to model, except when their vessels are of the same size, or built for specific purposes. Recourse, therefore, is had by the author to calculation for the determination of their respective resistances;—and here we must be allowed to object to his method of computing the values of these data. As nearly as his meaning can be ascertained, he assumes the hull resistances to be in the ratio of the squares of their midship sections divided by their displacements. *Why* this rule is selected, we are not so clearly informed; and it is easy to show such a method of arriving at the truth a *very* incorrect one.

The hull resistance of a vessel is composed of two elements;—one, the friction of the water against the sides and bottom; the other, a certain fraction (whose value depends on the perfection of the model) of the resistance experienced by a plane surface of the same area as the midship section, moving at an equal speed in a direction perpendicular to its plane. The first of these elements is proportional to the mean perimeter of all the immersed sections multiplied by the mean length of the vessel; and the second, of course, to the midship section itself,—both also varying with the squares of the velocities. It is evident, that, as the value of the "fraction" spoken of is dependent on the fineness of the lines, it may vary greatly with the same displacement; we are, therefore, not warranted in allowing this latter element to enter at all into our calculation. Here then will probably be found one of the great causes of error,—that the resistance (that most important point) is erroneously estimated by Mr. I., thus vitiating all his conclusions in a practical point of view.

We might stop here, but there is another point to which attention should be called. It will be observed, that, in his calculation of *powers*, Mr. I., instead of deducting only the slip, and the power required to work the air pump, &c., thus leaving the whole available powers of the engines to be compared with each other, and with the effects produced, (the friction being of course proportional to the load,) has deducted *also* the (calculated) elements of oblique action in one wheel, and reaction in the other, which, being precisely the causes of economical difference between the two kinds of wheel, are precisely those which should have been left to be determined by the results of the comparison; so that, in fact, the only thing really proved by that comparison, as made by him, is, that either his *powers* or his *effects* are erroneously calculated.

If this be not the case, where does the difference go? to what is owing the ratio of 1·000 to 0·9055? The author first calculates the *respectively* disputed elements—deducts them from his powers, thus *reducing the wheels to an equality* in effect; and then, because the powers so obtained do not correspond with the resistances he has calculated, we are told that the difference is owing to the respective values of the two wheels.

After thus endeavoring to point out the causes of error in some of the conclusions deduced from the practical part of Mr. Isherwood's paper, we desire to say a few words about his theory. The whole matter has been before so ably discussed by English and other engineers, that, in truth, little remains for more modern writers than to sum up what has been already said.

It has been acknowledged by the most sanguine advocates of Morgan's wheel, that, even theoretically considered, it is more valuable than the ordinary form *only* in deeper immersions than ·235, or about one-fourth, of the diameter of the wheel,—which, as Mr. Isherwood confesses, and as we all know, is rarely exceeded, even by vessels going out of port for a two weeks' voyage, and *never arrived at* in American sea steamers which are fitted with larger wheels than the generality of European vessels. When this wheel was first brought before the English public, its inventor and friends, overlooking the very important fact, that, in a vessel in motion, the action of the wheel is very different from that of the same wheel while the vessel is at rest; and that in fact, the vertical position of the float is, in the common wheel, so far from being the best, as would *a priori* be supposed, absolutely the *worst* for propelling purposes;—overlooking, we say, these facts, magnified the importance of the advantages possessed by Morgan's wheel, in which the floats are always vertical, and the central position that most advantageous in propulsion. From this difference it results that the amount of surface in *one float* of Morgan's wheel must be nearly as great as that of all the floats immersed in the common wheel, in order to involve as little slip. This being incompatible with the advantage claimed, of less space occupied by the former in the width of the vessel, it is generally found to give a greater slip than the radial wheel, and consequently to involve a greater expenditure of fuel in order to drive a vessel at the same speed. A case might be adduced in which, upon the trial of two English steamers, built, with this exception, (the form of wheel,) precisely alike in every respect, it was found that, to attain the same speed, the Morgan wheel had to make two more revolutions per minute than the other,—of course involving a greater consumption of fuel.

We do not desire to underrate the value of the new wheel; it undoubtedly enters and leaves the water with less shock than the other, may be made somewhat narrower, (though not to the extent asserted by Mr. I.,) to produce the same economical effect, and is more efficient at deeper immersions than one-fourth its diameter, which advantage rapidly increases after that point. On the other hand, however, it is much more expensive at first, more wasteful in fuel at ordinary immersons, has greater wear and tear, and increased liability to get out of order, consequent to the severe shocks it undergoes at sea, and to the want of attention bestowed upon it during a long voyage, besides the increased friction brought upon the engine by so many more working parts.

To a due consideration of these circumstances is probably owing the slow progress hitherto made by Morgan's wheel in the favor of British engineers; for it is not to be denied that, in their practice at the present day, its use forms the exception and not the rule. But, whatever be its popularity with them, the reasons opposing its introduction into our own steam marine cannot but possess weight with those interested in its economy, particularly when it is remembered that the peculiar construction of American steamships, differing as it does in many important points from that of European vessels, forbids an application of the same standard to both, and that what might be called an improvement in one, would, from this cause, be entirely inexpedient in the other. M.

Report on the Explosion of the Locomotive Engine "Erie," on the Western Railroad, on the 29th June, 1850.[*]

Boston Society of Civil Engineers,
August 5, 1850.

The undersigned, appointed at the monthly meeting held July 1st, 1850, to examine into the facts connected with the recent explosion of a locomotive engine on the Western Railroad, on the 29th of June last, having attended to that duty respectfully submit the following report:—

On Wednesday, the 3d of July, the Committee went to Springfield, and there examined the engine as it stood in the engine house. It was stated to the Committee that the machine was in the same situation it was in when brought to Springfield after the explosion.

Description of the Engine.—This engine, named the "Erie," was built by the Taunton Locomotive Company for the Western Railroad, and was placed upon that road April 3d, 1848, since which time it has been in use on freight trains.

The class it belonged to is known as the "20-ton engines," with four drivers. It was built for a freight engine, in the usual manner of building such kind of engines at those works.

The iron forming the shell of the boiler was $\frac{3}{8}$-inch plate throughout, stayed in the manner then in common use at that manufactory. The braces, six in number at the end blown out, did not go through from end to end, but both ends were stayed by short bars attached to the end plates, and fastened upon the inside of the shell of the boiler, consequently placed on lines diagonal to the direction of the length of the boiler, and to the direction of this explosion.

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[*] From the Boston Courier, August 19, 1850.

The iron plates from which the boiler was made appear to be good, and of the usual thickness and quality of iron; but, to avoid mistake in this point, your committee have taken steps to have the matter settled by direct experiment upon the iron itself.*

Since coming upon the road it has run on an average with the other engines, and has had also about the average amount of repairs put upon it, as compared with other engines of its class and age. It had never met with any accident to injure it, and was considered as good an engine of its class as any on the road. It had been used altogether as a freight engine, and had, with but few exceptions always run between Worcester and Springfield.

The injury to the boiler and machine was confined to the part immediately in front of the platform, on which the engine man stands. The plate forming this end of the boiler was torn from its connexion with the other parts, and pressed downwards, and nearly covered the platform. The extent of the fracture was the width of the entire plate, and to the depth of the lower side of the furnace door, and line of the fracture following the bend in the iron, by which the edge was turned in order to fasten it to the other parts; in no case did the line of fracture follow the rivet holes, and the only variation in the line was on the lower part of the fracture, where it was torn for the distance of six inches diagonally across the sheet.

The stay-bolts were all separated from their connexions with the other part of the boiler, three remaining upon the part torn off, the others remaining attached to the main part of the boiler.

The machinery adjoining this part of the engine was broken and injured, and part of the top of the house torn off. The remaining part of the engine was but slightly injured.

After the examination of this part of the boiler, an examination was made upon the inside, but we were unable to see any indications of great or excessive heat, but as the fire remained in the furnace for some time after the explosion, it is possible the tubes may be found burned when the engine is taken apart.

The safety valves were next examined, and both found screwed down so far as to render them inoperative.

The back valve was entirely rigid, and the lever could not be moved in the least degree. The forward valve could be moved slightly, but not more than from one-eighth to one-sixteenth of an inch at the end of the lever, which would give no motion at the valve which could be of any use in relieving the boiler from undue pressure of steam. These valves, we are assured, were in the same position that they were in when the engine was brought from Clappville to Springfield.

Having examined the safety valves as they were found, the balances were unscrewed, and the caps and valves opened. The valves and seats were found in perfectly good order, and free to act if they had not been prevented by being screwed down.

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* The iron has not, as yet, been received in Boston.

A general examination was made of the rest of the machine, but nothing worth noting in connexion with the explosion was found. The tender tank was moved from its position, and somewhat injured. The whole pecuniary damage done by the explosion was estimated at $1200.

After the examination of the engine, the committee returned to Boston, and on Wednesday, the 10th instant, returned to Springfield, to get such information from the men attached to the train and others, as might serve to explain further the cause of the accident.

Mr. William Jennings, the conductor of the train, stated: "We started with this freight train from Worcester at 40 minutes past 11, A. M., on Saturday the 29th of June. The train consisted of 38 cars,—in length between 500 and 600 feet; of which five or six were platform cars, and 24 of the cars were loaded. The amount of freight was about 150 tons. This train was drawn by the "Erie,"—engine-man, John Nonnegon; fireman, Wm. Whitman. There were three freight trains started from Worcester, with the usual interval of time between,—we were the last—overtook the other trains at Clappville.

"We remained at Clappville until the other trains went on. We remained there about thirty minutes—took in wood and water, and shifted some cars on to the side track. The wood we took in at this place was white pine, and very dry. We started from Clappville, and ran up the inclined plane about one-half a mile—put down the brake and stopped between five and eight minutes.

"At the time the explosion took place, I was on the north side of the train, about two hundred feet back from the engine. Heard the signal for starting, and the engine exhaust two or three times, when I heard the report of the explosion, and found the wood from the tender falling around me. The largest part of the wood fell near where I stood; part of it was thrown as far as six hundred feet from the engine. The engine-man was thrown about two hundred and fifty feet, and killed instantly by the explosion.

"My opinion is that there was water enough in the boiler at the time of the explosion. I think so from my knowledge of the engine-man;—have known him for a year and a half, and always considered him to be a very careful man about keeping his water up. I have never known him to get his water low.

"The engine did not blow-off at Clappville, nor did I hear the steam blow-off at all. The engine-man complained that the engine did not make steam so well as formerly. We had no difficulty in drawing our loads. The engine was as competent to draw thirty loaded cars up a sixty feet grade as any other engine of its class on the road.

"The fire remained in the furnace in all about thirty minutes after the explosion, before it was put entirely out. We put in earth first to check the fire, as we could get no water; the tender tank, being broken by the explosion, let the water out, and there was no water near the place where the explosion took place.

"Mr. Moore found the safety valves screwed down hard at Clappville, immediately after the explosion. Mr. Baker was the first engine-man who arrived at Clappville after the explosion."

Mr. Charles Moore, the assistant conductor, stated that—"I found the safety valves screwed so hard down that they could not be moved to allow the steam to blow-off. It was not more than 10 or 15 minutes after the explosion that I saw them; the rods were blackened by the explosion in such a manner that if the valves had been changed within that time it could have been detected.

"There had not been, to my knowledge, any other person upon the engine after the explosion before me. I was careful to allow no other person to get on. In my opinion there was sufficient water in the boiler at the time of the explosion. I judge so from the appearance of the cars, &c., being wet, and the fragments of clothing remaining upon the body of the engine-man were wet with water."

William Whitman, fireman, stated—"I stood by the side of the engine in the act of getting on when the explosion took place. My clothes were wet with water, and I was badly scalded by it. When we started from Clappville I filled the furnace with wood; there was no more wood put in until the explosion took place. The wood was very dry and burned freely. The engine blew off a very little from the back scale; none from the forward one. Could just hear the escape steam as I stood by the side of the engine. I had been with this engine-man one and a half years; never knew him to get his water low; have known him to get too much in; he did so once that day. He was a careful and temperate man, so far as I know. He was in the habit of changing his balances on the different grades,—screwing them down when working up a heavy grade, and raising them up on levels and down grades. Never heard him make any remarks that the engine was weak or out of repair."

Mr. James Baker, engine-man of passenger trains, stated—"I was the first engine-man at Clappville after the explosion. It was about three hours after it took place. I found the back valve tight down; it could not be moved at all. The forward valve lever could be moved a little—about one-sixteenth of an inch. The screws were not altered when the engine was brought to Springfield.

"I judge that there was a sufficient supply of water in the boiler, from the appearance of the tender and cars,—the water from the boiler being somewhat muddy, and leaving its marks upon them.

"Running passenger trains, I never alter my scales (balances). When I used to run freight trains, I was in the habit of altering them upon different grades.

"I noticed that, on the day this explosion took place, the engines made steam very freely. The scales are weighted to about 150 pounds to the square inch."

From this examination, your committee are of opinion that the immediate cause of this explosion was the condition of the safety valves, which (through carelessness or inadvertency) were screwed so closely down as to be entirely inoperative, and thus rendered the boiler a close vessel, with no power to relieve itself from undue pressure but by explosion. The witnesses all agree upon this point.

The escape steam, mentioned by the fireman, must have been very slight, as he stated he could but just hear the escape as he stood by the side of the engine, and it probably came from a slight leak at the valve.

From the statements of the men near the train, and from the appearance of the tender, which we saw ourselves, we are of opinion that there was water enough in the boiler at the time of the explosion, and *consequently it was not occasioned by a deficiency of water in the boiler.*

In regard to the strength of the boiler, the committee believe that it was sufficient for the usual working pressure of steam, but had not a proper *excess* of strength; and they think proper to recommend that the system of using short stay-bolts only, for the heads of boilers, should be discontinued, and that there should be always added to them long bolts passing through from end to end, as, in their opinion, the additional security against accidents from undue pressure will more than compensate for any inconvenience which may be experienced in the boiler by their introduction. This system has been adopted by the parties who built the "Erie," since the construction of that engine.

They would also again recommend, as was done in the report upon the explosion on the Eastern Railroad, that the balances attached to the valves should be so arranged that it should be out of the power of the engine-man to place them in the condition of those found upon the "Erie," as being the only simple and safe prevention of such accidents, whether arising from want of discretion or from ignorance.

Waldo Higginson.
Wm. P. Parrott.
J. H. Blake.

Report of Prof. Chas. G. Page, *upon Electro-Magnetism as a Moving Power.*[*]

The Secretary of the Navy on Tuesday sent to the Senate, in answer to their call for information, the following report from Professor Charles G. Page, being an outline only of his experiments in the application of electro-magnetism:—

Washington, *August* 30, 1850.

Sir: In compliance with your request, I have the honor to report to you the progress made in my experiments, under the act of March 3d, 1849, appropriating $20,000 for "testing the capacity and usefulness of the electro-magnetic power as a mechanical agent for the purposes of locomotion and navigation, and the probable cost of using the same."

A schedule of expenditures incurred up to this date, amounting to $12,667·28, is herewith annexed, by which it will appear that considerably more than one-third of the appropriation remains yet unexpended. Outstanding bills remain amounting to about $1000, most of which is charged at the Navy Yard for material, which, when deducted, will leave about one-third of the appropriation for further prosecution of the experiment.

From the brief time allowed, it will be impossible for me to do more in this report than to give an outline of the experiments which I have repeated

[*] From the Washington National Intelligencer, September 5, 1850.

and recorded during the past year. Their full detail and explanation will form a volume replete with interesting scientific matter, and require much time and labor.

The first principal experiments were made with a small trial engine, built expressly for the purpose, and with the utmost care in reference to mechanical accuracy. Attached to this was a dynamometer of new construction, and admirably adapted to the purpose. This was invented by my principal engineer, and measured in a most satisfactory manner the dynamic power of the engine at any given velocity—a great desideratum in estimating this new power. With this trial engine, the following important questions were tested:

1. The dynamic values of different qualities of soft iron.
2. The dynamic values of steel,—hard and soft.
3. The dynamic value of cast iron.

The statical values of all these varieties were tested by a separate apparatus constructed for the purpose, called the axial galvanometer. Twelve varieties in all were tested, and were in bars of uniform size, one foot in length, and one inch in diameter, and it was found that the statical and dynamic properties corresponded.

4. The proportions of the helices were approximately tested; though much remains unsettled yet upon this important point.
5. The advantage of keeping up the magnetism in the axial bar was most satisfactorily tested.
6. Various modes were tried of reversing the motion of the engine, and with success.
7. Various kinds of cut-off (which is the most critical and important point in the construction of the engine) were tried.
8. The operation of closed circuits and secondary currents was tested by a number of experiments, requiring great care and accuracy.
9. The best working velocity of this engine, and its absolute power with a given battery, was fully tested.
10. The ratio of the increase of power, with an increase in the quantity of the current.
11. The values of different kinds of metal in forming the cut-off.
12. Various mechanical points of construction, supposed to have been incompatible with the exhibition of this power, were put to a practical test.

Various other minor points also were the subject of experiment, which will be communicated hereafter.

A second model, of small size and somewhat rude construction, was also made, with a view of testing a new arrangement of the axial bars.

Experiments were then commenced upon a larger scale, with a view to determine whether the same proportion of power could be obtained from large as from small engines, this being the principal question in view at the time of the grant of the appropriation.

With a view to facilitate the construction of helices of large size, a machine which had long been in contemplation was made at a considerable expense. The work was done at the Navy Yard in a creditable manner, and the machine performed its work well, turning out entire helices of copper wire, of large size, from straight bars. But before I had proceeded far, a discovery was made in reference to the helix which rendered the machine useless, for the present at least.

A number of large helices were then constructed of various sizes, and suitable bars of soft iron prepared, corresponding to the helices. Hollow and solid bars were prepared, from two inches to eight inches in diameter, and generally three feet in length. Some bars of four and five feet in length were also prepared. The bars were all worked at the Navy Yard, and at a considerable expense, as they were required to be of homogeneous metal, accurately turned and bored.

With these bars and helices a multitude of experiments were performed and recorded, and these were kept up day after day for about two months. My official duties as Examiner in the Patent Office left me only the evening of each day for operation; and, under such circumstances, you will readily appreciate the difficulties and disadvantages under which I have labored. My own zeal has led me beyond my strength; but I have been richly rewarded by the most flattering results.

The experiments here were not such as could be performed upon the laboratory table; but were with large masses of iron, weighing in some cases three hundred pounds, and helices sometimes twice that weight.

Adhering to the same size of battery through a long series of experiments, and varying the coils and bars, I found, to my great gratification, that as I increased the dimensions of each a corresponding increase of power was exhibited, and the consumption of material, or cost of the power, in some proportion diminished. These results were encouraging and stimulating in the highest degree, and fully justified the undertaking at once, of an engine upon a much larger scale than any hitherto tried.

This engine, the framework of which was principally built at the Navy Yard, was an upright engine of two feet stroke; and in order to have facilities for comparative trials and experiments, it was necessary that a double engine should be made, the two parts exactly corresponding. Two bars of soft iron, six inches diameter and three feet in length, were the prime movers, and these were balanced by means of connecting rods and cranks upon a fly-wheel shaft. The balance wheel and shaft together weighed six hundred pounds. When this engine was first tried, with the same battery which had before given me one-fifth of a horse power, with a smaller engine, it produced only one-third of a horse power. By careful attention to the adjustments, and particularly to the cut-off, which was a very different thing now from what it had been in smaller engines, the engine soon yielded one horse power. Here was a gain of eighty per cent. as measured merely by the size of the battery. But it was much more; for the cost was found to be less for one horse power than it had been before for one-fifth of a horse power, in a smaller engine; how much less has not yet been ascertained.

A great variety of experiments were continued with this engine, to be hereafter detailed, each having a definite object; and, I am happy to say, each resulting advantageously, so that finally, by little daily increments, I obtained from this engine, by a trifling addition of battery, a full two horse power.

By way of giving a practical character to the engine, it was geared to a circular saw ten inches in diameter, the turning lathe and grindstone of the workshop, all of which it worked simultaneously, as witnessed by a number of visiters, and, if I mistake not, by your predecessor in office, in company with Lieut. Maury, of the National Observatory.

After many satisfactory trials with this engine it was taken down, and all its available parts used in the construction of the single horizontal engine which I had the honor lately to exhibit before the Smithsonian Institution. This change was made for the purpose of dispensing with the dead weight of one of the driving bars, and more particularly for introducing the important feature of keeping up the magnetism of the driving bar. As soon as this new form was completed and tried, a gain of one-half horse power was at once realized, and by the addition of a few more feet of battery surface, the power was found to be above four horse. Further addition of battery would still augment the power, and I see no reason why ten horse power might not be obtained from this engine by the addition of more battery; but whether it would be economical to increase power by this means alone, and to ascertain the point, for this and every other engine, beyond which economy would cease, by increasing the battery alone, are matters to be determined by experiment.

The next most important point to be determined was the expense of this power. Much to my own surprise and gratification, the expense was found to be less than the most expensive steam engines; although recently, in Europe, it has been decided by experimenters and men of science, and generally conceded, that it was fifty times the cost of the dearest steam engines. It is still, however, considerably dearer than the cheaper sort of steam engines; but this is no obstacle to its introduction, considering its immense advantages in other respects. Moreover, if thus much has been done in the very inception of this undertaking, what may we reasonably expect from its further prosecution?

Before it can be rendered available in practice much remains to be done with the galvanic battery, to render its action regular and durable, and in other ways to establish a certainty of action, so that the engines may be managed by persons not thoroughly skilled in the subjects of electricity and magnetism.

It remains yet also to be proved whether the power will increase in proportion to the size of the engines. This principle seems to be strongly indicated by past experiments, but yet it cannot be established by calculation or process of reasoning. Experiment upon an extensive scale can alone determine this point. A part of the work preparatory to building a locomotive engine has been done; but it seems necessary to try further experiments before incurring the expense of another large engine upon the plan above mentioned. The rotary form of the engine has not yet been tested, although it possesses advantages not to be found in any form of the reciprocating engine. There are some obvious disadvantages attending its construction; but it is hoped that they will be outweighed, more especially as this form of the engine will occupy less than one-half the room required for the reciprocating form.

It would seem very desirable that the investigation thus begun, and so far successfully conducted, should be carried at least beyond *an uncertain issue*, and that *every important point* should be settled, and particularly that of its availability on an extensive scale. The power is peculiarly fitted for purposes of navigation, if it can be made subservient; and a trial upon a scale of 100 horse power seems to be the only mode of arriving at a definite conclusion upon this point. It is obvious that, preliminary to such an undertaking, a great many experiments will be absolutely necessary; and such only as one quite familiar with the difficulties of entering upon an entirely new field of operation can properly appreciate.

In conclusion, I beg leave to refer you to the enclosed report of a debate before the American Scientific Convention recently held at New Haven, (See *Nat. Intel.*, Aug. 29,) which will indicate the opinions of men of science upon this all-important subject.

I have the honor to be most respectfully, your obedient servant,

CHAS. G. PAGE.

HON. WM. A. GRAHAM,
Secretary of the Navy.

Note.—The expenditures under the appropriation were placed by the act making it under the supervision of the Secretary of the Navy; and, we understand, were made only upon bills approved by the head of that department, which are filed as vouchers in the proper office. No compensation whatever is allowed to Professor Page for his services in making the experiments, nor for the great amount of scientific knowledge he has to aid him in carrying out the provisions of the law.—*Eds. Nat. Intel.*

On Resin and Water Gas. *By* ANDREW FIFE, M. D., *Professor of Chemistry, King's College University, Aberdeen.**

Though, during the course of the last year, I had been engaged in conducting experiments on water resin gas, I did not think it necessary to make the results public, because, after what had been stated in scientific journals, I had thought that the proposal to introduce this gas, for the purpose of illumination, had been abandoned. The very remarkable statement advanced in the Journal for April last by Mr. White, patentee for a process of manufacturing the gas, shows, however, that this is not the case; but that, on the contrary, he still maintains not only that the process is an economical one, but also that the gas afforded is of high illuminating power, and consequently that it is cheaper than other gases are as a source of light. The appended remarks in the same number of the Journal, are sufficient proof of the inaccuracy of some of Mr. White's statements, and of the little prospect there is of water resin gas, *as manufactured by him*, coming into use, especially in those places where coal is to be had at a reasonable price; I trust, however, notwithstanding what has been already advanced regarding the process, that the few observations which I am now about to submit, the result chiefly of experiments, will not be deemed valueless. I give them because it is a subject of such vast importance that I consider it to be the duty of every one who has any information regarding it to make it public; and then to allow those who are qualified to judge to say whether attempts to introduce this gas, as an economical source of light, ought still to be persevered in.

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* From the London Mining Journal, No. 779.

It is well known that when water is passed over iron at a red heat, excluded from air, it is decomposed; oxide of iron is formed, and hydrogen gas is evolved, the purity of which depends on the kind of iron employed. Were the iron clean and pure, then pure hydrogen would be the result; but this very seldom occurs in practice, because not only does the iron contain foreign ingredients, but it is soiled also by the hands and tools of the workmen in the factory from which it is procured, in the state of filings or turnings. Hence it is that the specific gravity of the gas which it yields is considerably beyond that of pure hydrogen, and the appearance of the flame is different. The light afforded is extremely faint.

When water is passed over carbon, either as coke or charcoal, at a red heat, and excluded from air, decomposition ensues, and a gaseous fluid escapes, with regard to the nature of which different opinions have existed. It was at one time supposed to be, and indeed in works on chemistry it has been described as, a mixture of a variety of gases, the principal of which is light hydro-carbon, better known as *marsh gas*, *coal mine gas*, and *fire-damp*. More recently performed experiments, however, have proved that it does not contain hydro-carbon, or at most but a trifling quantity of it. In a paper published by me in the *Edinburg Philosophical Journal*, July, 1837, it is shown that the gas produced by this process is a mixture of hydrogen, carbonic oxide, and carbonic acid, the proportions varying according to the heat and other circumstances. In these trials I found that the carbonic acid was about 18 per cent. After removing it, the remainder was of specific gravity 470, and consisted of a mixture of hydrogen and carbonic oxide in about equal proportions. By combustion it yielded carbonic acid and water, the light afforded being extremely feeble. As the gas, after the removal of the carbonic acid, was of specific gravity 470, it must have been, before its removal, of specific gravity about 660.

Allowing the correctness of the results now stated, it is evident that when water is brought into contact with iron and carbon at a red heat, in the same vessel, the gas evolved will be either hydrogen alone, provided the whole of the oxygen unites with the iron, or it will be a mixture of hydrogen, carbonic oxide, and carbonic acid; the proportions varying according to the surface of carbon and iron exposed, and to the facility with which the vapor of the water is brought into contact with the one or the other. Of course the specific gravity will also vary according to circumstances. I have already said that both carbonic oxide and hydrogen burn with a very feeble flame, and give very little light. The appearance of the flame of the mixed gases will, of course, vary according to the proportions.

The following experiment was made with the view of ascertaining the illuminating power of the gas prepared from water, by the process recommended by Mr. White, though not exactly with the same arrangement. The retort used was the one which I employed in my trials with coal gas, previously recorded. It was stuffed with charcoal and scrap iron, which were brought to the proper temperature after the door of the retort was secured. Water was then allowed to flow in, the supply being regulated by a stop-cock. The gas given off was measured in the usual way. From 7½ lbs. of water 59½ cubic feet of gas were evolved, the specific gravity of which was 574. By lime-water the condensation amounted to 16·5 per cent., indicating, therefore, that quantity of carbonic acid; that is, about $\frac{1}{6}$th of its volume. Had the specific gravity been taken after abstracting the carbonic acid, it would have been found to be very nearly the same as that formerly mentioned, that is, between 470 and 500. The gas burned with a very feeble bluish flame, yielding carbonic acid and water. With a flame five inches long, from a jet with an aperture of $\frac{1}{33}$d of an inch, the consumption was one foot in 32 min. 30 sec., that is 1·84 feet per hour.

The illuminating power was tried by the method described in No. 6 of this Journal, using the argand with 56 holes, having a button to spread the flame. The standard light was a wax candle, six to the pound, consuming 140 grains per hour. The argand burned one foot in 5 min. 50 sec., that is, very nearly 10 ft. per hour. The spot on the Bunsen screen disappeared when the distance between it and the candle was 40 in., and that between the screen and the gas-burner was 6 in. and $40 \times 40 \div 6 + 6 = 44$. The wax candle was, therefore, giving 44 times as much light as the burner consuming 10 feet per hour, evidently showing that water gas, thus manufactured, is valueless for the purpose of illumination. This trial of the illuminating power was made on the gas without having abstracted the carbonic acid, which, it has been stated, amounted to upwards of 16 per cent. This, I would say, is a defect in the process for procuring water gas as originally introduced by Mr. White, and hence in all probability, the cause of the great specific gravity of the gas as stated by him. Had the gas been freed from carbonic acid, *as it ought to have been*, by putting it through lime purifiers, the specific gravity would have been much less; but this would not only have diminished the quantity evolved from a given weight of material, but also would have reduced materially the specific gravity, which it is of consequence to have as high as possible, when specific gravity is given as a test of the illuminating power. This also shows the extreme absurdity of putting any confidence in specific gravity alone, as a test of the value of a gas for the purpose of illumination.

Before leaving this part of the subject, I may advert to an opinion entertained by some, viz., that durability alone is a good indication of the value of gas. In this instance the durability was 32 min. 50 sec. That of the gas from the best English caking coal I have formerly stated to be 50 min., and that from an average Scottish Cannel coal to be 60 min. By the most advantageous modes of combustion, 10 feet of the English gas gave the light of 27·3 candles; of the Scottish gas, the light of 60 candles; while the same quantity of water gas gave that of only $\frac{1}{44}$th of a candle. The illuminating power and durability, therefore, bear no proportion whatever to each other; consequently, durability alone gives no indication of the illuminating power of gases.

The next set of experiments was made on resin, with the view of ascertaining the quantity and quality of the gas which it affords, by decomposition at different degrees of heat. The resin was melted cautiously, and poured into the reservoir connected with the retort, previously brought to the same heat as that requisite for the manufacture of coal gas. By a proper contrivance, it was kept warm and sufficiently fluid to enable it to flow easily; 6 lbs. 2 oz. yielded 61 feet of gas, that is, very nearly 10 feet from the pound. The gas was of specific gravity 640. Lime-water indicated 10 per cent. of carbonic acid. With a jet $\frac{1}{33}$d of an inch in diameter, and a 5-inch flame, the durability was 50 min., that is, 1·2 ft. per hour. By the photometer the jet gave the light of 2·2 candles per foot. The argand with 56 holes, consuming 5 feet per hour, gave the light of 2·45 candles per foot.

This gas being of a specific gravity 640, a cubic foot would weigh 343 grains. The gas, therefore, in all, weighed nearly 3 lbs.; consequently upwards of one-half of the resin employed was wasted by the deposit of carbon in the retort, and by the distillation of volatile oil.

A second trial was made with the retort at a dull red heat: 2 lbs. 8 oz. of resin gave 16½ feet of gas of specific gravity 657, and containing 6 per cent. of carbonic acid. This is equal to 6·2 feet per pound of resin. The durability, with a jet $\frac{1}{33}$ of an inch in diameter and 5-inch flame, was 48 min., that is 1·25 feet per hour. With the jet flame the light was that of 1·68 candles per foot; with the argand it was that of 2·27 candles per foot. The specific gravity of this gas being 657, a cubic foot would weigh 352 gr., which would make the total quantity be 5888 gr.; the resin employed was 18,664 gr., consequently, two thirds of it had disappeared as deposited carbon and volatile oil.

A third trial was made with the heat rather higher than in the second, but lower than in the first experiment. 7 lbs. 6 oz. of resin gave 64 feet of gas of 419 specific gravity, and containing 8 per cent. nearly of carbonic acid; that is, equal to 8·42 feet per pound of resin. With the jet the durability was 41 min. 40 sec., that is, 1·43 feet per hour. In this case the loss also amounted to upwards of one-half of the resin employed.

A fourth trial at nearly the same heat was made: 6 lbs. of resin afforded 55 feet of gas of 613 specific gravity; that is, rather more than 9 feet per pound. In this case the loss amounted to upwards of one-half of the resin. Of these four trials, the first is by far the best, not only as to quantity, but also as to quality of the gas afforded, a pound of resin having yielded 10 feet of gas, the illuminating power of which was equal to that of 2·45 candles per foot. This is very nearly the same as that of the best English caking coal gas, to which I alluded in No. 9 of the *Gas Journal*.

From the above trials, it would appear that during the conversion of resin into gas there is a considerable loss. I was anxious to ascertain whether this was owing to any imperfection in the apparatus, or whether it always accompanies the decomposition. I was fortunate in having an opportunity of putting this to the test, by having been obligingly offered the use of an apparatus erected under the superintendence of Mr. White himself, for the purpose of supplying water resin gas, according to his patent process, to a private dwelling house. The apparatus was a very small one, consisting of two retorts, the one vertical, for the decomposition of water, the other horizontal, for the decomposition of resin. In the following trial the resin retort only was used:—5 lbs. of resin, cautiously melted, afforded 44 feet of gas of 574 specific gravity, that is, 8·8 feet per pound. The per centage of carbonic acid was not ascertained. From the low specific gravity it was, perhaps, not great. The condensation by chlorine was 8. The durability with the jet and 5-inch flame was 53 min. 20 sec., that is, 1·12 ft. per hour. With this jet, the light was that of 1·14 candle per foot. Owing to a deficiency of pressure on the gasholder, I could not get a sufficient supply of gas to enable me to ascertain the illuminating power by the argand. I could not make it consume beyond 3 ft. per hour, which was too small a quantity to have profitable combustion. I have previously shown that, for the consumption of equal quantities, the light given by a good argand is to that given by a jet as about 1·8 to 1. Giving this gas, then, every allowance, the illuminating power by the argand could not exceed that of 2 candles per foot.

To be continued.

For the Journal of the Franklin Institute.

Marine Steam Navigation for 1850.

It is now some thirteen years since the "Great Western" first made her appearance in the harbor of New York, and in her we obtained our first correct ideas as to what an ocean steamer should be. Previous to her arrival all our sea steamers (coasters) were of a mixed nature,—a compound of river and sea steamer combined, making fair vessels for good weather, but showing their lack of sea qualities in heavy storms. A few years sufficed to show us that something quite different was wanted, even for our coast, but it was some time after the arrival of the "Great Western," and when she had been in the trade for several successive seasons, making her trips to Liverpool and back with great regularity, before any progress was made, or even the first attempt to build a regular sea steamer for commercial purposes, (although the Government built the "Missouri" and "Mississippi" steamers in 1841.)

It was about 1846 that the steamer "Southerner" was built, to run between New York and Charleston, S. C. She was after the English model so far as general appearance was concerned, but differed from them in her internal arrangements. Her length was 180 feet on deck, 30 feet beam, 14 feet hold, 716 tons; with one side lever engine, built by Stillman, Allen & Co., New York, with cylinder 68 inches diameter and 8 feet stroke. She was very successful, and is still in the same trade.

The ground once broken, each year produced several sea steamers, some of which had defects of a serious nature, caused by a want of experience in that department of engineering. Passing over the intervening years we reach the present, which, from the large number of steamers built, and their great success, will go far to put us on an equality, if not actually ahead, of Great Britain, our only rival.

Below I give you an account of all the *sea steamers* built or building during the year 1850.

In New York, amounting to 37,540 tons, as follows—

"Atlantic," Liverpool steamer, 290 feet long, 46½ feet wide, 32 feet hold, 3000 tons; two side lever engines, cylinders 95 inches diameter, 9 feet stroke, built by Stillman, Allen & Co.

"Pacific," Liverpool steamer, same size and model as the "Atlantic;" engines also the same size, and built by the Allaire Works.

These vessels are the fastest sea steamers afloat, making better time than the "Asia," although they are of equal power, and the "Asia" is 500 tons the smallest.

"Arctic," Liverpool steamer, hull same size as the "Atlantic;" engines have the same diameter of cylinder but one foot more stroke, and are built by Stillman, Allen & Co.

"Baltic," Liverpool steamer, same size at the "Arctic;" engines built by the Allaire Works.

"Franklin," Havre steamer, 250 feet long, 26 feet hold, and 40 feet beam, 1900 tons: two side lever engines, cylinders 93 inches diameter and 8 feet stroke, built by Stillman, Allen & Co.

"Humboldt," Havre steamer, 280 feet long, 40 feet beam, and 28 feet hold, 2200 tons; two side lever engines, cylinders 95 inches diameter, 9 feet stroke, built by Stillman, Allen & Co.

"Columbia," Pacific steamer, 800 tons; two side lever engines, size unknown, built by Stillman, Allen & Co.

"Florida," Savannah steamer, 200 feet long, 32 feet beam, 21 feet hold, 900 tons; one side lever engine, cylinder 75 inches diameter, 8 feet stroke, built by Stillman, Allen & Co.

"———," Savannah steamer, of same size, and by same builders.

"———," Pacific steamer, 225 feet long, 40 feet beam, 20 feet hold, 1700 tons; two oscillating engines, by Stillman, Allen & Co.

"———," Charleston steamer, 200 feet long, 32 feet beam, and 21 feet hold, 900 tons; one side lever engine, 70 inches diameter of cylinder, and 8 feet stroke, by Stillman, Allen & Co.

"———," Pacific steamer, 220 feet long, 36 feet wide, 24½ feet hold, 1360 tons; one side lever engine, by Stillman, Allen & Co.

"———," Pacific steamer, 225 feet long, 40 feet beam, 20 feet hold, 1700 tons; two oscillating engines, by the Allaire Works.

"———," Charleston steamer, 212 feet long, 34 feet beam, 22 feet hold, 1170 tons; two side lever engines, cylinders 60 inches diameter, 7 feet stroke, by the Allaire Works.

"———," Liverpool (propeller) steamer, 2000 tons, propeller 15 feet diameter, engine by the West Point Foundry.

"———," Pacific steamer, 230 feet long, 31 feet wide, 19 feet hold, 1070 tons; one beam engine, cylinder 70 inches diameter, 10 feet stroke, by H. R. Dunham & Co.

"———," Chagres steamer, 230 feet long, 31 feet beam, and 23 feet hold, 1070 tons: two beam engines, cylinders 50 inches diameter and 10 feet stroke, by Cunningham & Belknap, Phœnix Foundry.

"———," Texas steamer, 215 feet long, 33 feet beam, and 19 feet hold, 1100 tons; one beam engine, cylinder 56 inches diameter, 10 feet stroke, by the Morgan Iron Works.

"———," Texas steamer, same size and same builders.

"North America," Pacific steamer, 255 feet long, 34½ feet beam, 22 feet hold, 1470 tons; one beam engine, cylinder 60 inches diameter, 12 feet stroke, by the Morgan Iron Works.

"San Francisco," Pacific steamer, 250 feet long, 40 feet beam, 24 feet hold, 1900 tons; two side lever engines, by the Morgan Iron Works.

"———," Pacific steamer, 220 feet long, 35 feet beam, 14 feet hold, 1300 tons; one beam engine, 72-inch cylinder, 11 feet stroke, by the Morgan Iron Works.

"———," Liverpool (propeller) steamer, 210 feet long, 32 feet beam, 26 feet hold, 1000 tons; two engines, connected direct to propellor shaft, cylinders 50 inches diameter and 44 inches stroke, diameter of propeller 14 feet, by Hogg & Delamater.

In Philadelphia 3807 tons, as follows:—

"Philadelphia," Chagres steamer, 190 feet long, 33 feet beam, 18 feet hold, 975 tons; two side lever engines, cylinders 56 inches diameter, 6¾ feet stroke, by Merrick & Son.

"Constitution," Pacific (propeller) steamer, 180 feet long, 26 feet beam, 18 feet hold, 570 tons; two direct acting engines, cylinders 34 inches diameter, 34 inches stroke, propeller 10 feet diameter, by I. P. Morris & Co.

"Union," Pacific (propeller) steamer, of same size; engines by Reaney, Neafie & Co.

"Pampero," Pacific steamer, 140 feet long, 26 feet beam, 10½ feet hold, 357 tons; one inclined engine, cylinder 50 inches diameter, and 6 feet stroke, by Reaney, Neafie & Co.

"———," Pacific (propeller) steamer, 153 feet long, 24½ feet beam, 17 feet hold, 435 tons, two engines geared 2 to 1, cylinders 24 inches diameter, 2 feet stroke, by Sutton & Co.

"———," Charleston (propeller) steamer, 180 feet long, 27 feet beam, 18½ feet hold, 600 tons; two oscillating engines geared 1¾ to 1, cylinders 40 inches diameter, 40 inches stroke, propeller 10 feet diameter, by Sutton & Co.

"———," Venezuela Navy, 138 feet long, 23 feet beam, 10 feet hold, 300 tons; two direct action engines, cylinders 25 inches diameter, 24 inches stroke, propeller 7 feet diameter, by Sutton & Co.

In Baltimore,—

Steamer "Monumental City," (propeller,) 175 feet long, 30 feet beam, 15 feet hold, 750 tons; two oscillating engines, cylinders 44 inches diameter, 3 feet stroke, one 4-blade propeller, 12 feet diameter, by Murry & Hazlehurst.

Being a total of 42,097 tons, all of which could be used for naval purposes if desired. B.

For the Journal of the Franklin Institute.

On the Economical Application of the Waste Gases from Blast Furnaces.

By Hu. L. Damsel.

The economical application of the waste gases from blast furnaces has engaged the attention of several iron-masters in the South Wales iron-making district during the last twelve or eighteen months, and not a few of them have expended large sums in their endeavors to turn these otherwise useless products of combustion to profitable account. The results of their experiments (which have been conducted at an immense cost—in some instances exceeding £10,000) are so very different, however, from what the promoters of the measure anticipated, that a brief outline of the facts brought to light may not be wholly uninteresting to the proprietors of similar establishments in Pennsylvania and adjoining States.

The experiments have proved, beyond a doubt, what was well known on the continent of Europe, namely, that, by attention to the manner of collecting, conveying, and applying the gas to the boilers, the blowing engines can be worked without the employment of coal fires. But it is found that the heat given out by the ignited gas is much inferior, both in quantity and intensity, to that from coal fire, and that two boilers with fires will generate as much steam as three with the gas apparatus. From this it will be apparent that, with the gas, an increased number of boilers are required, entailing a large outlay of capital in addition to that expended on the apparatus for the collection and conveyance of the gases. This large expenditure of capital, however, would be no obstacle to its permanent adoption by the large Welsh proprietors if the saving of fuel was real instead of being, as it is in practice found to be, imaginary.

It is found that, with the abstraction of the gaseous products of combustion, a larger quantity of fuel is required in the blast furnace to smelt a given weight of iron-stone. This increased consumption, while it is in no one case less, is in some greatly in excess of the saving effected by the use of the gas at the engine fires and hot air stoves. In addition to this increased consumption of coal in smelting, the plan is attended with the further disadvantage, that, immediately on the application of the apparatus for the abstraction of the gases, the make of the furnace is largely reduced. Furnaces which formerly produced 150 and 160 tons per week, now produce only 120 to 130 tons, although, in all other respects, working under precisely similar circumstances.

These are the principal disadvantages, but others of scarcely less importance are found to attend the plan. Among these may be mentioned great irregularity in the working of the furnace. "Scaffolding," or a jamming together of the materials in the body of the furnace, so as to form an arch, the gradual descent of the materials under which ultimately occasions a large cavity to be left, is of frequent occurrence with the gas furnaces. Persons conversant with the economy of an iron-works well know how very important it is that the materials charged into the mouth of the blast furnace should descend regularly and uninterruptedly, and the trouble and annoyance occasioned when it is otherwise.

This scaffolding of the materials in the interior of the blast furnace, and their subsequent sudden descent of several feet at a time, forms one of the greatest obstacles to the successful application of the plan. That this may be the better understood, it will be necessary to mention that the gas is collected by sinking into the mouth of the furnace (so that its upper end be level with the charging plates) a wrought iron tube or cylinder, five or six feet deep and six or eight inches smaller in diameter than the furnace mouth. In the ordinary course of filling the furnace this cylinder is kept full of materials, but around the exterior of that portion below the mouth of the furnace an annular chamber is formed by the space between it and the interior of the furnace; from this chamber the gas is collected by means of pipes or orifices in the lining of the furnace, and conveyed away to the fires. Whenever the materials within this cylinder descend below its mouth, as is frequently the case when the furnace is "scaffolding," the atmospheric air—at all other times rigidly excluded—now obtains admission to this chamber. On these occasions the quantity of air which mixes with the gas is so great as to destroy its heating properties, and render it useless for generating steam.

That the increased consumption of fuel, and reduced make of iron, is owing to the abstraction of the gas there can be no doubt, for whenever the collecting apparatus is removed, or when, from any cause, it is not in operation, an immediate change is observed in the working and produce of the furnace.

Furnaces working with coke fuel evolve a large quantity of gas of considerable heating power; those working with semi-bituminous coal in the raw state give less gas and of a lower power, while furnaces using anthracite as a fuel give the least of any that have been tried.

As might be expected, these unlooked for results have completely checked the further application of the principle; but though the experiments made have thus far been unsuccessful, they have not yet been abandoned. The extent of capital swallowed up in alterations for the adaptation of the plan to the existing engines and stoves, and the hopes entertained by some of the most experienced iron-masters, that it will ultimately prove successful, have hitherto prevented this being done; but should the next twelve months not witness some important improvement on the present system of collecting and applying the gas, so as to obviate the disadvantages which now attend its application, it will be finally abandoned.

The non-success which has attended these attempts to economize fuel, by withdrawing the heated gases, &c., from the blast furnace, and applying them to other purposes, deserves the serious consideration of furnace proprietors in Pennsylvania and Maryland; for though the plan of connecting the hot air stove with the tunnel-head may not have an equally injurious effect on the working, yield, and produce of the furnace with the one described, there is too much reason to fear that it increases rather than diminishes the cost of smelting. A careful comparison of the coal consumed in converting the ore into pig iron, with that used in Welch furnaces working on the open plan, offers a ready means of ascertaining what advantages or disadvantages attend the respective systems. An inquiry of this kind would necessarily involve some time and expense, but the information derived from it would be of very great value to those interested.

Glamorganshire, Aug. 30, 1850.

The principal objections urged in the above article to this most important improvement in manufacturing iron, appear to be an increased consumption of coal, a diminished yield, and a tendency to scaffolding.

That the mere fact of using instead of wasting the gases escaping at the tunnel-head, after they have entirely finished their action on the charge, should seriously affect the working of the furnace, seems so strange a result as to lead to the suspicion that the mode in which the change was attempted may have had more share in producing it than the change itself.

It will be observed that all the furnaces spoken of above seem to have been altered for the purpose of collecting the gases in the same manner: that is, by sinking a wide-flanged iron pipe several feet from the tunnel-head, feeding the charges through the pipe, and collecting the gases from the annular space left outside of it. In a passage thus made, both much narrower than before, and cylindrical in place of conical, the tendency of the materials to arch and jam is so much increased that the furnace must often lose, from these causes, the whole beneficial effect of the pressure of six or eight feet of its contents,—a loss of itself apparently sufficient to account for all the accidents of scaffolding mentioned in our correspondent's letter.

The serious effects upon both the yield and burden, produced by even slight alterations of the height and diameter of the upper part of a furnace are well known to iron-masters; many singular results of the experience on this subject in the Scotch and Staffordshire iron districts are recorded by Mr. Thompson in the *Transactions of the Glasgow Philosophical Society.*

By drawing off the gases through lateral flues near the top of the stack, in the manner originally practised in Germany, the previous form of the furnace can be preserved unchanged, and under such circumstances only can a fair trial of the merits of the system be expected.

The application of the waste flame to heating the blast has, in this country, been in general use almost as long as the hot blast itself, and we believe that it has, for several years, been successfully applied to raising steam. We hope, therefore, that some of our own manufacturers will favor us with results of their experience on this interesting subject.

R. A. T.

For the Journal of the Franklin Institute.

Remarks on Radial and Vertical Paddle Wheels. *By* T. W. Bakewell.

An investigation of the comparative merits of the radial and vertical paddle wheels, for steam vessels, is given by B. F. Isherwood, Esq., Chief Engineer U. S. Navy, in the August and September numbers of the *Journal.*

This investigation of Mr. I. suggests the bringing to notice, through the same medium, an important error, not peculiar to Mr. Isherwood, but adopted, it is believed, by all orthodox writers on the subject.

The error involves an injustice to the radial wheel in assigning a loss, *i. e.* power unprofitably applied, by the oblique action of the paddle on the water.

The distance advanced by the vessel, and retired (slipped) by the paddle, *together*, determine the amount of power or steam used: in other words, the two slips, that of the paddle and that of the vessel.

There is no slip of the vessel vertically, and if we give the entering paddle its greatest obliquity, (horizontal,) the wheel being immersed to the shaft, then the slip of the paddle would alone remain, which if resisted, the engine would be stationary. This example covers all the minor positions of obliquity.

Mr. I. estimates the slips of the radial and vertical paddles about equal, and observes, "The comparison is then narrowed down between the loss by oblique action of the radiating paddle wheel, and by friction of the moving parts, and reaction of the perpendicular paddle wheel;" and states, that, in usual practice, the loss by slip, with a 28 feet diameter wheel, is about 18 per cent., and the loss to the *radial wheel* by oblique action about $18\frac{1}{3}$ per cent.

The result of Mr. I.'s examination makes the efficiency of the two kinds of wheels nearly equal, while impaired by the above error of $18\frac{1}{3}$ per cent. loss, ascribed to obliquity of action in the radial wheel.

Cincinnati, Ohio, 1850.

On Certain Phenomena of Forced Dilatation of Liquids. By M. MARCELIN BERTHELOT.*

If a somewhat strong capillary tube, closed at one end and drawn out at the other to a slender point, is filled with water at the temperature of 28° or 30° Cent.; if this tube is cooled down to 18°, so as to cause a certain quantity of air to enter it at the open point, and it is then closed, and again heated to 28° and gradually higher, after a certain time the air is completely dissolved. If cooled to 18°, the original temperature at which the tube contained at the same time gas and liquid, it is seen that the water continues to occupy the whole of the internal capacity, and maintains thus an invariable density between 28° to 18°. Its temperature may even be lowered still more. At this moment the least shock or collision, the least variation, causes the instant re-appearance, with a sort of ebullition, a slight noise, and a shock more or less perceptible, of the gas dissolved in the water. It dilates rapidly, and in less than a second has resumed its primitive volume at 18°. I have made the same observations with the following liquids, selected from all classes: water, solutions of various salts and gases, solution of soda, various acids, alcohol, ether, acetone, Dutch liquid, essence of turpentine, oil of olives, kreosote, sulphuret of carbon, chlorides of metalloids and metals, bromine. Mercury is the only liquid with which I have not succeeded, either in the presence of the air or *in vacuo*. A bubble of air remained several days in presence of the mercury without dissolving, at least completely, and that under pressures of 200 to 300 atmospheres, produced by preventing for that length of time the dilatation of the mercury due otherwise to an increased temperature of 8° to 10°.

In these phenomena there are two things very distinct. 1. An unstable supersaturation of the liquid by the gas, produced under the influence of the pressure. There are numerous examples of this order of facts. 2. A state of forced dilatation of the liquid; the latter, in fact, an instant before the vibration, fills the volume which the gas occupies an instant after conjointly with it, and this volume is the same which the dilated liquid filled on an elevation of temperature of 8° to 10° and more. The variation of density thus produced is enormous; for water it is equal to $\frac{1}{420}$th of its volume at 18°; for alcohol to $\frac{1}{93}$, for ether to $\frac{1}{59}$. Such an effect would be produced in an opposite direction only by a pressure of 50 atmospheres for water, of 150 for ether. This phenomenon is very general, as is proved by the variety of the liquids on which I have operated. It probably accompanies all supersaturations, but at variable degrees and in various directions, without being capable of being proved.

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* From the London, Edinburgh, and Dublin Philosophical Magazine, for August, 1850.

Following the advice of M. Regnault, I endeavored to separate the two facts, and to produce the dilatation of the liquids *in vacuo*. A peculiar apparatus enabled me to fill the tubes with liquids absolutely freed from air, and to close them without letting any gas enter. Under these new conditions, I reproduced the phenomenon of forced dilatation with water and ether, and have thus seen that it is independent of supersaturation. This permanence of the density of the liquids in an interval of temperature more or less considerable, appears to me attributable to the adhesion of the glass and the liquid: it is a force which is opposed to the division of this latter; and which can only be destroyed by an increase of the molecular attraction of the liquid for itself, an increase produced under the influence of cooling.—*Comptes Rendus*, June 24, 1850.

Statistics of Gas in England and Wales.[*]

There are now in England and Wales 560 proprietary gas works, and in Ireland and Scotland 170. Besides these there are thirty-three which belong to private individuals, and twelve the property of municipal bodies or parish officers; in all, 775 distinct establishments for the manufacture and sale of gas. In these works a capital of 10,500,000 is said to be invested. The quantity of gas annually produced is about 9,000,000,000 cubic feet, and the coal consumed in making it weighs 1,125,000 tons. The number of persons employed in its production is about 20,000; and probably an equal number finds employment in the preparatory work in the mines, iron-works, and other processes connected with it. After allowing for waste and leakage, the quantity of gas actually sold to the public, in the year, is about 7,200,000,000 feet, producing a light equal to what would be given out by 32,133,640 gallons of sperm oil; which, at eight shillings a gallon, would cost the consumers £13,223,456. The gas itself is charged by the companies about £1,620,000.

On a New Voltaic Battery. By Prof. H. Reinsch.[†]

Prof. H. Reinsch, in the *Jahrbuch* of Practical Pharmacy, describes a new voltaic battery of considerable power without the use of any exciting metal. A common porous cell is filled with powdered coke, into which is fixed a rod of coke for conducting the current. This porous cell is placed in a jar or glass, which is then filled with coarse bruised coke, to which is also connected a rod of the same material. The coke in the inner cell is moistened with nitric acid,—that in the external one with a solution of common salt; conducting wires being attached to the coke cylinders, a tolerably strong current is indicated. Dr. Reinsch has rendered a small electro-magnet sufficiently magnetic by this current to sustain half a pound; but a large electro-magnet was not affected by it. The spark and shock have been very decidedly obtained from a single compound cell; and from the indications afforded, we may hope to obtain much greater power at a small cost of material.

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[*] From the London Civil Engineer and Architect's Journal, for August, 1850.

[†] From the London Athenæum, for July, 1850.

On Certain Conditions of Freezing Water. *By* Mr. Faraday.*

The chief object of Mr. Faraday's discourse was the great, various, and extraordinary forms of affinity which exist between the particles of water. Having experimentally illustrated the combining power of water, and shown how this attraction passes from a physical to a chemical force, Mr. Faraday confined the rest of his discourse to ice, as being that condition of water in which its particles are allowed to associate with each other without the intervention of foreign matter. Such ice as is now imported into this country under the name of the Wenham Lake ice (though it is chiefly supplied from Norway) may be regarded as one of the purest natural substances.

Mr. Faraday first showed how entirely coloring matter, salts, and alkalies are expelled in freezing. A solution of sulphate of indigo, diluted sulphuric acid, and diluted ammonia, were partially frozen in glass test tubes; as soon as the operation had been carried on long enough to produce an icy lining of each tube, the unfrozen liquid was poured out and the ice dislodged. This ice was found in every instance perfectly colorless, and when dissolved, perfectly free from acid or alkali, although the unfrozen liquid exhibited in the first experiment a more intense blue color, in the second a stronger acid, and in the third a more powerful alkaline reaction than the liquor which was put into the freezing mixture. Mr. Faraday also devised a method for making this ice perfectly clear and transparent as well as colorless. By continually stirring the liquid, while freezing, with a feather, he brushed away globules of air as fast as they were dislodged from the freezing fluid, and thus prevented their becoming imbedded in the ice.

Having noticed the rapidity with which water absorbs air as soon as it is thawed, Mr. Faraday called attention to the importance of this natural arrangement to aquatic plants and animals, to whose life air is as indispensable as to those which live on land. Mr. Faraday then referred to Mr. Douny's discovery that water, when deprived of air, does not boil till it reaches the temperature of 270°, and that at that degree of heat it explodes. He mentioned that he suggested to Mr. Douny that ice, when placed in oil, (so as to prevent its receiving any air from the atmosphere on thawing,) would probably explode on reaching the boiling temperature. This experiment had been successfully tried by Mr. Douny, and was as successfully repeated on this occasion.

Mr. Faraday then invited attention to the extraordinary property of ice in solidifying water which is in contact with it. Two pieces of moist ice will consolidate into one. Hence the property of damp snow to become compacted into a snowball—an effect which cannot be produced on dry hard-frozen snow. Mr. Faraday suggested, and illustrated by a diagram, that a film of water must possess the property of freezing when placed between two sets of icy particles, though it will not be affected by a single set of particles. Certain solid substances, as flannel, will also freeze to an icy surface, though other substances, as gold leaf, cannot be made to do so. In this freezing action latent heat becomes sensible heat, the contiguous particles must therefore be raised in temperature while the freezing water is between them. It follows from hence that, by virtue of the solidifying power at points of contact, the same mass may be freezing and thawing at the same moment, and even that the freezing process in the inside may be a thawing process on the outside.

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* From the London Athenæum, for June, 1850.

Mr. Faraday then referred to Mr. Thomson's memoirs on the effect of pressure on the freezing point. Mr. Thomson has shown that immense pressure will prevent water from freezing at 32°—ice naturally occupies a greater volume than that of the water which forms it. And we may conceive that when ice is pressed the tendency is to give it both the water bulk and state.

In conclusion, Mr. Faraday noticed briefly, and chiefly by way of suggestion, the molecular condition of ice as presenting many curious results, and called attention to the strangeness of stiræ being formed in a body of such uniform composition as pure water frozen into ice.—*Proc. Roy. Inst.*

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, September 19th, 1850.

Samuel V. Merrick, President, in the chair.

Thomas Fletcher, Vice President.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations were received from The Royal Cornwall Polytechnic Society, England; The American Cannel Coal Co., Louisville, Ky.; John McRae, Esq., Charleston, S. C.; Prof. Caleb G. Forshey, New Orleans, La.; Dr. R. S. W. Rushenberger, U. S. Navy; Prof. John S. Hart, Messrs. Prosper Martin, Henry Whitall, Robert Frazer, and Solomon W. Roberts, Philadelphia.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of receipts and payments for the month of August.

The Board of Managers and the Standing Committees reported their minutes.

The resolution reported by the Committee on Exhibitions at the last meeting was amended and adopted.

New candidates for membership in the Institute (17) were proposed, and those proposed at the last meeting (5) were elected members of the Institute.

Geo. W. Smith, Esq., offered the following preamble and resolution, which were unanimously adopted, as follows:

Whereas, Mr. I. W. P. Lewis, Civil Engineer, has on several occasions personally appeared before the stated monthly meetings of the Franklin Institute of the State of Pennsylvania, and ably explained at great length the improvements in the illumination of lighthouses by the introduction of the Dioptric system, and illustrated the subject by numerous large and well designed drawings, as well as by the actual exhibition of revolving, fixed, and flashing Dioptric Lights, of the actual size in use, which had been procured by him at great expense, and for which he has declined any remuneration: Be it therefore,

Resolved, That the Franklin Institute has heard with high interest the statements of Mr. Lewis, and view with much pleasure his early, zealous, intelligent, and long continued efforts to introduce the Dioptric system into use in the United States,—a system which has already received the unanimous approval of this body.

Resolved, That the thanks of the Franklin Institute be given to Mr. Lewis, for the gratification which he has afforded to it, and also for his courtesy and liberality in loaning it the Dioptric Apparatus at the last Annual Exhibition.

The President having stated that he had received an invitation from the Massachusetts Charitable Mechanics' Association, at Boston, to the Franklin Institute, to be present by its delegation at the Exhibition of Manufactures now being held there, the following resolutions were offered by Dr. Turnbull and unanimously adopted, viz:

Resolved, That the thanks of the Franklin Institute be returned to the Massachusetts Charitable Mechanics' Association for their kind invitation, and that the President be authorized to appoint delegates to the Boston Exhibition.

Resolved, That an invitation be given to the Massachusetts Charitable Mechanics' Association to be present by their delegation at the Exhibition of American Manufactures to be held by the Franklin Institute in this city, between the 15th and 26th days of October next.

Mr. G. W. Smith called the attention of the meeting to a printed copy of a letter from Mr. James McQueen, dated London, August 26th, 1850, stating that the sources of the Nile had at last been ascertained, in its main or eastern branch, by recent journeys from the north and from the south-east coast of Africa, Portuguese travelers having recently made us acquainted with the sources of the western branch. The expedition of the Pacha of Egypt, in January, 1840, traced it at that time to lat. 3° 22′ N., and long. 31° 41′ E., there 1300 feet broad, and coming from the south-east, from a lake. From that point to the source is a distance, in the general bearing, of 270 geographical miles, sufficiently great to form a river of that magnitude, especially in a country so mountainous as that portion of Africa is found to be.

The Rev. Dr. Krapf, a missionary from the Church Missionary Society, long stationed in Eastern Africa, has at length obtained this important information. In a journey, he reached lat. 1° S., and long. 35° 30′ E., to Kitui, the capital of Unbekani, a fine and friendly people. There he saw to the north-west, distant about six days journey, Mount Kenia rising far above the limits of perpetual snow, (the Chimborazo of Africa, and under the equator,) from the southern base and side of which springs the river Dani; and to the north of it, he was told, rose a river running to the north, down which the people went to the country of the white people,—doubtless the Nile. Thus the information given to us by Martin of Tyre, by Bruce, and by the Priests of Egypt, in their communications to Herodotus, are at length confirmed, and the physical peculiarities of the river satisfactorily accounted for. The Nile is, therefore, not only the longest river on the earth, but runs through more degrees of latitude than any known.

An excellent transparent substance, well adapted to replace the marine glue of Jeffries for many purposes, particularly where a transparent joint is required, as in the union of pieces of glass, invented by Mr. S. Lenher, of Philadelphia, was exhibited, and its properties explained. From its transparency, it was suggested by the Chairman, Mr. G. W. Smith, as admirably adapted for the union of the parts of polyzonal lenses and rings. Small glass boxes, for containing microscopic objects, united by it, were shown, and gave much satisfaction. The composition of the cement is as follows: caoutchouc 15 grs., chloroform 2 oz., mastic ½ oz. The two first named ingredients are to be first mixed; after the gum is dissolved the mastic is added, and the whole allowed to macerate for a week, which is about the time required for the solution of the mastic in the cold. More of the caoutchouc may be added where great elasticity is desirable. The convenience of its application with a brush, cold, recommends it for approval.

Some microscopic preparations of Dr. Paul B. Goddard, of Philadelphia, in which the most minute vessels of the human body were most admirably injected with vermillion, &c., were described by the Chairman. The vermillion being previously very finely ground in oil, was mingled with sulphuric ether, and slowly injected with a very fine syringe. The exquisite beauty of these specimens attracted much attention and deserves especial notice.

Mr. G. W. Smith alluded to the various catoptric and dioptric lighthouse apparatus, whereby a large portion of the sphere of light emitted from lamps placed in the foci thereof was economized, and especially drew the attention of the meeting to the singular fact, that, of the whole cone of light projected to the horizon from either lenses or reflectors, the whole of the upper half of the cone, being projected above the horizon, is totally wasted, being visible only to birds in the air or to men in balloons. He suggested the inclination of the lenses or reflectors, (as the case may be,) so that the axis of the projected cone may be directed, not to the horizon, but slightly *below* it. He called on the members at the meeting for some explanation of the causes of this useless waste.

I. W. P. Lewis, Esq., C. E., being present, admitted the waste, and suggested that, in order to obviate it, the apparatus must be varied in its position in lighthouses according to their heights, which might be attended with inconvenience in the manufacture of apparatus, and the adjustment of them at the place of use.

Some discussion took place respecting new lighthouses now in progress in the United States, in which the dioptric system is to be introduced, the intelligence of which facts seemed to interest the meeting.

The Holophotal Sphere of Mr. Thomas Stephenson, C. E., of Scotland, was explained to the meeting and illustrated by drawings. This instrument is intended to economize all the light emitted by a lamp placed in its focus. The anterior half of the sphere is precisely similar to an analogous invention of Mr. G. W. Smith, of Philadelphia, made about two years ago, and submitted to the Franklin Institute subsequently for examination, a drawing of which is contained in a previous number.

The novelty of Mr. Stephenson's plan consists in the posterior half of the apparatus, the interior of which is a perfect hemisphere, the exterior consisting of rings placed in parallel vertical planes. Any portion of these rings receiving the light emitted from its centre, at right angles on its interior surface, the ray penetrates without refraction to the exterior surface of the ring, which is curved in a paraboloidal form—is there reflected totally to the opposite surface, curved in a similar manner; thence again reflected totally from a similar surface on the opposite side of the ring to the central focus, whence it is emitted, and thus reinforces the rays of light falling upon the anterior portion of the dioptric apparatus. All the light is thus rendered available, excepting that small portion absorbed in the passage through the glass, and the portion intercepted by the lamp itself.

Dr. Rand exhibited to the meeting the Prussian Rifle, as improved by Mr. John Würfflein, Jr., of the firm of Würfflein & Psotta, gunsmiths, of Philadelphia. This gun is celebrated as having been used with great effect against the Danes in the Schleshwig-Holstein war, and is remarkable for its long range. The principle of the weapon, which loads at the breech, is that of lighting the powder of the charge at the upper portion, so that it ignites backwards. This is effected by placing the percussion powder in the cartridge next the ball; this percussion powder is ignited by means of a needle, which, when the trigger is pulled, starts from the breech of the gun, traverses the axis of the cartridge, and explodes the percussion powder, and, consequently the whole charge from before backwards. The mechanism of the lock is, as improved by Mr. W., highly ingenious, while at the same time it is more simple than an ordinary gun lock. It is provided with a safety apparatus, which renders an accidental discharge of the piece almost impossible. But few experiments have as yet been made with this rifle in this country; at one trial it was found, at a point blank shot of 150 yards, to drive the ball through a 4-inch cedar plank; its maximum range has not been yet ascertained.

Dr. Rand also presented a very light short rifle, made by the same firm, which is characterized by having projecting into the barrel, in its axis, from the breech, a short stiff iron pin, a little over an inch long; the ball rests on this pin when driven home. By this arrangement the lead of the ball is forced into the rifles without the grains of the gunpowder being crushed. This rifle, at a distance of 350 yards, with an elevation of a quarter of an inch, drove its ball through a pine plank an inch thick. It is so light that it might be fired with one hand.

Mr. Grimes introduced and described his apparatus for showing upon a graduated column the height of water in a steam boiler, as well as the pressure of the steam. This apparatus will be more fully described hereafter.

Committee on Science and the Arts.

Report on Seth E. Winslow's Lamps, for Burning Camphene, &c.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, to whom were referred for examination—"Lamps for Burning Camphene, &c.," invented by Mr. Seth E. Winslow, of Philadelphia, Pennsylvania,—Report:—

That they have examined the lamps, and that some of the Committee have made use of them. The improvement consists in the employment of a double system of lampwick instead of the single continuous wick used heretofore. One portion of wick passes down into the fluid, and, by the principle of capillary attraction, elevates the fluid to the top of the lamp; the other portion of wick passes only through the tubes of the lamp, and covers the lower surface of the movable top. When the top of the lamp is screwed down to its place the two portions of wick are brought into close contact, and the fluid passes readily by capillary attraction from one to the other.

When it is desired to replenish the lamp, while lighted, with fluid, the top of the lamp with its portion of wick is removed and placed at any convenient distance; this part of the wick retaining a sufficient quantity of the fluid to support the flame during the time occupied in replenishing it, thus furnishing the necessary light for this operation; at the same time the removal of the flame to a distance from the body of the lamp containing the fluid greatly diminishes the danger of explosion. The explosion of this species of lamp results chiefly from the accumulation of the vapor in the space above the fluid as the fluid consumes. This vapor is highly inflammable, and, when mixed with a portion of air, becomes highly explosive. Careless persons, in filling the old lamps with burning-fluid, neglected to extinguish the flame, and merely raised the top while burning. The danger of explosion from the proximity of the flame was very great, as the numerous accidents from the use of those lamps witness.

The Committee, therefore, think that much of the danger incident to the use of camphene lamps for domestic purposes is removed by the improvement of Mr. Winslow.

It was thought by the Committee that the separation of the wick would probably diminish slightly its feeding capacity, and the flame would not be quite as strong as with the old continuous wick; so that the lamp of Mr. Winslow would be more readily extinguished by a sudden movement or by a gust of wind. This, if it is the case, is, however, a slight inconvenience compared to the diminution of risk, and your Committee therefore recommend this lamp to those who make use of the burning fluid.

By order of the Committee,

William Hamilton, *Actuary.*

Philadelphia, April 11, 1850.

BIBLIOGRAPHICAL NOTICE.

Elements of Natural Philosophy. By W. H. C. Bartlett, LL. D., *Prof. Nat. & Exper. Philos. in the U. S. Military Academy at West Point. Sec. I.—Mechanics. New York: A. S. Barnes & Co.; Cincinnati: H. W. Derby & Co.* 1850.

We have just received the above volume, and have but time to acknowledge the courtesy of the publishers, and to commend the style in which it is published. A work of this kind, which is much wanted among us, cannot be judged of without careful examination, and although the well-merited reputation of the author is an excellent guarantee for the excellence of the work, we must postpone a more explicit notice of it until the number for next month. Ed.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

NOVEMBER, 1850.

CIVIL ENGINEERING.

*A Chapter in the History of Railway Locomotion.**

Continued from page 230.

There was still considerable indecision in the matter on the part of the directors, although considerable partiality was evinced by the major portion of them in favor of the locomotive, provided engines of this class could be built of sufficient power, whilst their weight was kept below that of the existing engines, some seven or eight tons; and in conformation with the railway act, requiring that no smoke should be discharged.

To distinguish accurately what was the cause of this favorable leaning of the directors towards the locomotive system, after the very opposite evidence which they had received, may, perhaps, be deemed a straining of the point; but there is good room for the presumption, that the evidence supplied by Mr. Hackworth, through Mr. Robert Stephenson, in the letter which we have quoted, had considerable influence in determining their choice. No other person had at this period anything like the practical knowledge which he possessed, in reference to the working of railways by both systems, the relative merits of which he had fully tested on the Darlington line.

One of the directors—Mr. Harrison—having given it as his opinion, that the expectancy of a reward, to be offered to the public as an excitement to competition, would have the desired effect, this mode of procedure was at length adopted; and, in April, 1829, they offered a premium of £500 for the best locomotive engine, conformable with certain regulations and conditions. The story of the competition—in which Mr. Hackworth joined—with the results of the test of the different engines, has been often told.

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* From the Glasgow Practical Mechanic's Journal, for June, 1850.

It is to be regretted that Mr. Hackworth, as an agent of the Stockton and Darlington Company, had not more extended means for the more perfect accomplishment of his designs; and that only such time as could be snatched from their service could be devoted to his own plans. As the Company's means were little more than adequate to the repairs of their own plant of engines, a great part of the work in his trial engine was executed at other establishments—the boiler being made at the Bedlington Iron Works, and the cylinders by Messrs. Stephenson.

The "Sanspareil" had a cylindrical boiler, 6 feet long, and 4 feet 2 inches diameter, one end being flat, and the other hemispherical. The heating surface consisted of a double tube traversing the whole length of the boiler, and returning to the fire-end; the fire-grate and chimney being both at one end of the engine—the fire-grate in one tube, whilst the chimney terminated the other. The tube extended from the boiler to a length of about 3 feet, with a casing of a semicircular form surrounding it at the fire-end, except at the chimney, where this casing extended only 2 feet. With this arrangement a greater extent of heating surface was obtained, than if tubes limited to the boiler's length had been used. The length of the grate-bars was 5 feet, and the diameter of the tube at the fire-end 2 feet, reduced to 15 inches in the return tube, this being also the size of the chimney. The area of the fire-grate was 10 square feet; the area of the surface of water exposed to the radiating heat, or direct action of the fire, being 15·7 square feet; and that acted on by the carried heat, 74½ square feet. She was carried on four wheels, 4 feet 6 inches diameter. The boiler was very imperfect as a piece of workmanship, and considerable leakage resulted. To such an extent were the joints defective, that many of them had copper run in and caulked up to make them steam-tight. Of the cylinders the same may be said—six castings were made before two perfect ones were got. The sixth cylinder had to be substituted at Liverpool, immediately after the contest at Rainhill, the fifth having burst during the competition. The imperfection in this case was in the metal forming the partition between the bore of the cylinder and the port-way or steam pipe along the cylinder side, which had been cast and bored so thin in one part, as to leave less than $\frac{1}{16}$ inch of metal. The consequence was, that the engine had no sooner commenced working than the cylinder burst, when the race had to be run with one perfect cylinder only, whilst the fracture of the other one opened at every stroke a direct communication between the boiler and the chimney. Not only did this mal-adventure render the "Sanspareil's" case hopeless, by a tremendous loss of steam, but as each burst took place when the steam-slide opened the communication with the injured cylinder, a great quantity of fuel was ejected from the fire-grate. It is obvious that, under these circumstances, the "Sanspareil" had little chance against the "Rocket"—Messrs. Stephenson's engine—which was perfect in all its constructive details. As it was, the only superiority of the latter was in her economy of fuel. The trial run, indeed. was not of such a character as fairly to test the two engines—the distance being no more than 1½ miles. The blast-pipe of the "Sanspareil" was fitted to enable her to maintain her working pressure during a long journey; whilst the "Rocket," unprovided with this appendage, was capable of generating steam nearly as well when at rest as when in action. Thus the latter was enabled to get up a sufficiency of steam for her run previous to starting, and when brought to a stand at the stations regained the steam power lost during the run, which was well performed on so short a distance as 1½ miles. This would not have been the case in the regular journeys of a working line. Such a test, therefore, was practically worthless, in arriving at a due comparison of performance for a line of considerable length, like the Liverpool and Manchester.

Shortly after this trial, Mr. Stephenson being anxious to investigate the "Sanspareil's" blast-pipe, despatched a nocturnal visitant to inspect it and take its dimensions. Our informant on this little bit of finesse is the actual person who made the survey—he is still living. The result of the observation which he made was, that a similar blast-pipe was constructed and fitted to the "Rocket." The actual working efficiency of the "Sanspareil" has been tolerably illustrated in Mr. Armstrong's work on Steam Boilers, where he says that—"The original 'Sanspareil' of Mr. Hackworth, which all but successfully competed for the prize at the opening of the Liverpool and Manchester Railway, may still be seen regularly working on the Bolton and Leigh Railway, apparently not much worse for seven years' constant work, the boiler never having required any essential repair,* while its contemporary rivals, that have escaped the fate of the 'scrap heap,' have been re-made, and mended over and over again since the celebrated race at Rainhill, a fact which goes far to prove that the principle of this engine has not been so very much improved upon, except that it is not so well calculated for burning coke as coal. The 'Sanspareil' may frequently be seen at the Kenyon Junction, waiting for the Bolton trains from Liverpool, and plans of it may be seen in Dr. Lardner's work."

In one point the "Rocket" possessed a feature of eminent superiority, which has since proved to be the main-stay of the modern locomotive—in the small flue-tubes—the invention of Mr. Henry Booth, the talented secretary of the Liverpool and Manchester line, to whom railways owe much of their present practical efficiency.

The extreme lightness of the engines insisted on by the directors led to an objection against the "Sanspareil," on the ground of an excess of weight; but it was forgotten that, although in gross weight she exceeded her rival, yet on neither pair of wheels was there so great a pressure as in the latter. At this time, when each engineer was feeling his way, some curious specimens of locomotive mechanism were turned out. A letter written to Mr. Hackworth, by one of the directors of the Stockton and Darlington line, gives a facetious account of an engine supplied to that line by Messrs. Stephenson:—"I should have been extremely glad to have heard that fair play had been allowed to the different engine-makers who were competitors for the premium; from the very cool reception that a *Timothy* received from Forth street, George showed very plainly that he was much afraid of the Shildon production; and well they might, as they well know that every engine which they have yet sent has had great need of mending. The new one last sent was at work scarcely a week before it was completely condemned, and not fit to be used in its present state. The hand-gear and valve shave no control in working it. When standing without the wagons at Tully's a few days ago, it started by itself when the steam was shut off, and all that Jem Stephenson* could do he could not stop it,—it ran down the branch with such speed that old Jem was crying out for help, every one expecting to see them dashed to atoms; the depôts being quite clear of wagons, this would have been the case, had not the teamers and others thrown blocks in the way, and fortunately threw it off.

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* Since it was properly repaired immediately after the contest at Liverpool.—Ed. P. M. Journal.

"A similar occurrence took place on the following day, in going down to Stockton. As soon as the wagons were unhooked at the top of the run, away goes *Maniac!* defying all the power and skill of her jockey, old Jem, nor could it be stopped until it arrived near the staiths. Had a coach been on the road coming up, its passengers would have been in a most dangerous position. The force-pump is nearly useless, having had, every day it was at work, to fill the boiler with pails at each of the watering places. No fewer than three times the lead plug has melted out. This *Maniac* was a Forth Street production, and at last was obliged to be towed up to the *hospital* by a real Timothy† in front, on six wheels, and actually had twenty-four wagons in the rear as guard. It is now at head quarters at Shildon.

"From what I have heard of the doings with you, it appears that the engine which had *a Booth* as the inventor of the copper pipes in the boiler, was, without either judge or jury, to be the winner."

On Mr. Hackworth's return from Liverpool, he found the "Rocket" lodged in the shed, waiting his arrival; and, as the Company's engineer, he had to put her in the best possible repair. From the defective construction of the hand-gear, and the imperfection of her force-pump, these details had to be completely remodeled.

The next engine which figured conspicuously on the Stockton and Darlington line was the "Globe," which was the first ever designed with a crank axle. She was built from Mr. Hackworth's designs, by Messrs. Stephenson, as the Railway Company's hands were too full to allow of the work being done at their private establishment. The novelties carried out in her were—the crank-axle working by inside cylinders beneath the boiler, and a modification of the hand-gear, whereby the reversing was effected by a single lever—two drivers being placed on the axle, one on each side of the pair of eccentric sheaves. The wheels were four in number, 5 feet diameter, being the largest then in use. A single flue ran straight through the boiler, having the fire-grate in one end. A number of small tubes were also passed transversely through the diameter of the main flue, so as to form a species of spiral, the water being allowed to circulate through them. This arrangement effectively exposed a considerable surface to the action of the heat; and her steam-generating powers were much superior to any other engine of her time, having the same area of heating surface. Still, at this date, a great objection existed in the slow circulation of the water through the tubes, and the consequent accumulation of mud in the horizontal tubes, which, forming an incrustation, speedily destroyed them. Another novelty in her construction was the placing a copper globe on the top of the boiler, to serve as a steam-receiving dome—hence arose her name. This engine opened the branch line between Stockton and Middlesbro', a distance of four miles. Her rate was frequently fifty miles per hour.

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* Brother to the late Mr. George Stephenson.

† "Royal George" Engine.

All constructive innovations are invariably looked upon with distrust by the merely practical man; and when the designs for this first crank-axle engine were laid before Messrs. Stephenson for their execution, an objection was raised by one of the officials of the establishment, that the crank-axle would certainly involve a loss of power, as the efficient length of lever could only be calculated from the inside of the journal to the axle's centre.

In 1830, the increase of traffic on the Stockton and Darlington line, requiring an addition to the working stock of engines, two different modifications were designed by Mr. Hackworth. Both these were six wheelers, spring-mounted, and coupled throughout; the boiler of the first kind being 13 feet long. The flue consisted of a main tube, 9 feet long, by 2 feet 6 inches diameter, in one end of which the fire-grates were inserted. The other end was separated from the boiler by a partition-plate, into which a number of small copper tubes, 4 feet in length, were inserted, for the conveyance of the vapor through the remaining portion of the boiler to the smoke-box, which was at the contrary end to the fire. The cylinders were placed vertically at one end of the boiler, their connecting rods being attached to a crank-shaft directly beneath. This was a plain shaft, with two cranks keyed on its ends at right angles to each other. From these cranks, coupling rods passed to similar cranks on the axles of the whole set of wheels. The slide-valves were actuated by two eccentrics, having a single lever reversing apparatus; the force-pumps being worked by the same eccentrics.

In the second arrangement, the distinctive feature was in the heating surface—the valve-gearing, cylinders, wheels, and connexions being as before, except that the cylinders were mounted on framing projecting six feet from the boiler. The boiler was 10 feet long, by 4 feet 4 inches diameter, and the arrangement of heating surface presented some novelties now much in use in the northern Engligh counties, and termed a "return multitubular fire-tube." It consisted of a main tube, 2 feet 4 inches diameter at the large end, reduced to 2 feet at the opposite end, and 8 feet long. The large end contained the fire-grates, and at the small end a box of a D-shape was placed to receive the heated vapor after its passage through the main tube, conveying it back again through the water by a number of small copper tubes, surrounding the large tube on all sides except the bottom, being inserted in the tube-box at one end, and in the plate forming the end of the boiler at the other. At the fire end a semicircular box carried the smoke into the chimney. This arrangement proved to be the best of its day for the general traffic of the line, as well in its economy as in its durability, the flues having been repeatedly known to wear for six years without removal. It also afforded the means of a convenient removal of the heating surface, so that in an engine provided with a duplicate heating surface, the old one could be removed and a new one added, ready for work within three days. It is said that these engines have performed a greater amount of duty than any others extant.

We have now glanced at the various gradations of improvement in the early stages of locomotive building, which it is impossible to contemplate without paying a deserved tribute to the great ability displayed in this branch by Mr. Hackworth, at a time when everything had to be learned—when, indeed, engineers were utterly thrown upon their own resources. No later than 1846, one of the agents of the Stockton and Darlington Company stated, in reference to the last class of the engine we have described, that, "taking them weight for weight, they surpass any engine of the line."

If George Stephenson deserved the title of the "Father of Railways," we think we may at least claim for Timothy Hackworth that of the "Father of Locomotives."

American Engineering—Locomotives.[*]

Continued from page 234.

DISTRIBUNION OF THE WEIGHT UPON THE FRAME.

After the consideration of the framing, and the principles according to which a solid one ought to be constructed, we must next investigate the manner in which the boiler, or body of the engine, should be connected with it, or braced from it.

The usual form of boiler-stay need not be described—it is in principle the same everywhere. In the English engine the fire-box is generally riveted or bolted, at its extremities, to the frame. In American engines, an equalizing beam being used, the centre of which is equidistant from the wheel-centres, in the case of coupled drivers, it is plain, the attachments of the fire-box are best arranged, so that their bearing centres are also equidistant from the centre of the beam. This is attained in the manner shown in figures 1 and 2, page 220, Vol. II.[†] of this Journal, and in the subjoined view of the "Mohawk." In the manner of carrying the smoke-box or fore-end of the boiler, there is a wide difference between the two systems. In English engines, with a round smoke-box—Stephenson's outside cylinders, the "Jenny Lind" and others—a stay is carried to the frame, the same as for the barrel of the boiler in the engine here shown as No. 1., the wings are carried straight down, and bolted directly to the frame.

In American engines the smoke-box, with its heavy chimney, is a much greater weight, and therefore requires stiffer carriers. Great weight being placed at the top, and acting on the frame with greater leverage, this part must be doubly strengthened. In most inside cylinder engines we find—as in figs. 1 and 2 of the frames—the cylinders to rest on, or sometimes underneath, the broad frame-bar by flanches. The two cylinders are connected together, either directly by flanches cast on, or by a separate casting bolted in between them, and carrying the gudgeon for the centre-pin. The cylinders, or this intermediate casting, are furnished with top flanches, curved to the radius of the smoke-box, to which the latter is firmly bolted, being thus supported on a broad base. This will be understood by reference to fig. 3, the breadth of base being from 15 to 18 inches.

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[*] From the Glasgow Practical Mechanic's Journal, for May, 1850.

[†] Journ. Frank. Insti., Vol. XIX. pp. 153, 154.

How many boiler-stays are to be put on the barrel of the boiler?

Some engineers put in as few as possible, only one on the whole length. Some put in more, on the principle of a more equal distribution of the weight along the frame.

Experience has shown that a beam bears one-third more, if loaded along its whole length, than bearing only on the centre. Theory, or science, has proved why it must be so. Inversely, the weight remaining the same, it will be less strained; and therefore, as in the case of a locomotive, a greater proportion of its surplus strength is used to counteract lateral impulses. It may be objectionable to peforate the boiler with more holes than necessary; but it is still more objectionable to produce an unequal straining in the frame, and thus weaken it.

Using only one stay, it is of course placed somewhere near the middle of the barrel. Using more stays, we find them sometimes adjusted near the spring-bolts, as in fig. 2, page 220,* sometimes on either side. The first plan is not a good one; for at the spring-bolt, all the vertical vibration not taken up by the spring is received by the frame, and thence imparted to the boiler. Place the stays between the springs, and the effect imparted to the body of the engine is less than the amount received at the spring-bolt, in the ratio of its distance from it; for the stability is affected only when the wheels on one side do not stand upon one horizontal plane. The frame between two wheel-centres then becomes a lever; at one spring-bolt the force acts, the other is the fulcrum; the effect received by the stay is in the proportion of the two lever lengths.

In many English inside-cylinder engines, as those by Messrs. Sharp Brothers & Co., the transverse plate supporting the guide bars is at the same time a carrier to the boiler. There cannot be a better way of bracing at the same time both the frame-plates and the boiler from them. However the braces or stays are placed, the principle laid down in page 101, Vol. II., should never be lost sight of—that is, so to arrange the fastenings as to admit of the expansion of the boiler, without producing a straining on the frame and working parts. I know that many practical men laugh at this idea as a mere "theory;" but where such very great accuracy and delicacy of adjustment and workmanship is required as in a locomotive, to make it durable, every cause of straining, be it great or small, should be avoided; and in this case it is easy to do so. Granted that the expansion upon a length of 12 feet is scarcely perceptible, it acts injuriously by constant unvaried repetition. Does not every engineer know, that however delicately and firmly he adjusts his slide in a cold state, as soon as it becomes hot its position is slightly altered; and in setting it he makes an allowance?

The boiler stays have another duty to perform. They are not carriers only. By their means the engineer distributes his weight on the wheels in the necessary proportions. The points of support for the engine are those where the frame is suspended from the springs. The longer the spring, therefore, the greater is the base of support; this is the theory, and practice proves a long spring to be more effectual in steadying the engine than a short one. Taking the "Pyracmon" as shown in Tredgold, we find the length of the spring on the fore wheel to be 39 inches; the distance from the spring-bolt to the centre of cylinder, 5¾ inches; this gives the proportion of overhanging weight. It is still less, considering that the heaviest end of the cylinder is the back end, which throws the centre of gravity somewhat farther back than the centre of length. The greater size of driving-wheel in the "Iron Duke" allows the leading wheel to be brought further forward; and the centre of gravity of the cylinder lies behind the point of support, that is, within the base. In the engine shown in No. 1—the tank engine—the length from the spring-bolt to the centre of cylinder is about 23 inches; that gives its ratio of overhanging weight. In the "Caledonian" outside-cylinder engine, also shown in Tredgold, the length is about 13 inches; in a sketch I made of Stephenson's outside-cylinder engine, 1845, I find it to be 20 inches; and allowing for the difference of the length of stroke—20 and 22 inches—it might, with the same arrangement and a 20-inch stroke, be reduced to 18 inches: all so much in favor of these engines over No. 1.

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* Journ. Frank. Insti., Vol. XIX, p. 154.

On referring again to the excellent engravings in Tredgold, we find altogether a better distribution of framing at the front of the "Caledonian" engine than in the tank engine. As explained, the proportion of overhanging weight in the two, is as 13 to 24. Moreover, the centre of the axle, where the lateral impulse is imparted to the buffer plank, where, on the cylinder side, it is resisted, is in the "Caledonian" engine, 4 feet 2¾ inches. Above all, the centre of the boiler of the first, with 6-foot drivers, is 3½ inches lower in the tank engine than in the second, with 5½ feet, and 5 feet 1 inch drivers, while the boilers are the same size. Both engines running on the same line, under similar circumstances, the first is better adapted to resist oscillation. Moreover, the cylinder is carried by a double frame, 13 feet apart, and its centre line falls within this base; in the tank engine, at a great distance from the centre, it is bolted by one narrow flanch to the frame. At the centre of the cylinder the straining takes place.

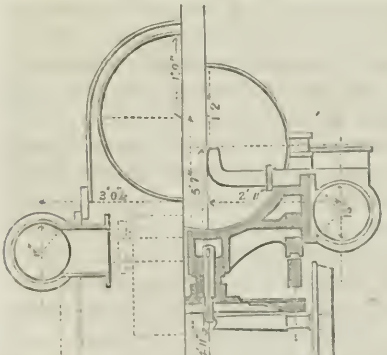

Fig. 3.—¼ inch = 1 foot.

The "Caledonian" certainly has the disadvantage of a high cylinder, lying at considerable inclination; but it is so much better supported and steadied, that this disadvantage is in effect much reduced. Were the length of flues in both the same, then its driving axle might be placed farther back, the length of connecting rod increased, and thus the angle of the stroke diminished, which would still more reduce the effect of the disadvantage.

Before leaving this subject, I refer to fig. 4. It shows part of an engine built here lately, on Crampton's plan, and, with the exception of truck and equalizing beam, is almost an exact copy. The driving-wheels are 7 feet diameter; the carriers 4 feet; the springs of both are connected by an equalizing beam, the centre of which can be shifted. Placed equidistant from the wheel centres, each wheel bears an equal weight; shifting the centre to one side, any amount of weight can be thrown on the drivers.

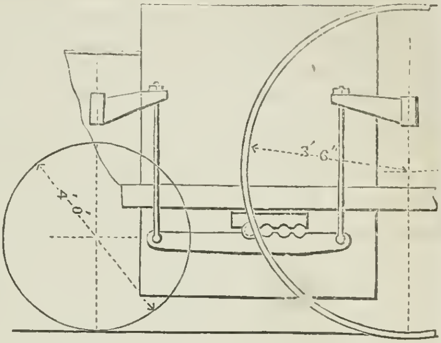

Fig. 4.—¼ inch = 1 foot.

We may now return to the comparison of No. 1 and No. 2. The first is a sketch of an English outside-cylinder engine, the second a corresponding one of an American engine. Their dimensions have been stated at page 219, Vol. II*. Fig. 3 gives half-cross sections of each at the centre of the cylinders, showing the attachments at this part. It may seem bold to place an engine by one of the most renowned firms in England, having at its command the greatest talent and experience, in juxtaposition with one only rebuilt, too, at a railroad workshop, in a town the name of which is scarcely known to the majority of the people of England. But a glance at the cross sections will convince the most sceptical how the one must be unsteady, containing within its construction the very causes of oscillation—high boiler, insufficient fastening of cylinder, and a great overhanging weight—whilst the other will move along the road as steady and smooth as possible.

I am favorable to outside connexions, and in many circumstances prefer them—a predilection which many years' connexion with railroads has not diminished. I think them both safe and economical—(see page 100, Vol. II.)—but they must be judiciously constructed. An engine like No. 1, when she has run a length of time, will be worn out much sooner than one with inside connexions. This will be no proof that outside cylinders are to be deprecated. The fault lies in the builder, not in the system.

In fig. 3, the position of the driving axle is shown by dotted lines. This will show how the position of boiler No. 2 is high enough for a 5½ feet wheel. We must not imagine, therefore, that the boiler is too high for a 5 feet wheel. Engines using wood as fuel require a greater depth of furnace below the barrel of the boiler, *i. e.* below the flues, than coke engines. The boiler in No. 1 is placed 7½ inches higher than need be. Why this inordinate height? It is not alone due to the tank. Even leaving the tank as it now stands, the boiler might have been lowered. But the same cubical content of the tank might have been preserved, had the boiler been lowered these 7 inches, and the top of the tank been curved to the shape of the boiler—thus gaining at the sides what was lost at the centre; or, there is room enough to admit of the eccentrics being shifted 1 or 1½ inches closer to the frame, and then widening the tank. In the distance of the centres of cylinders, an alteration might have been introduced. They are, in No. 1, 6 feet ½ inch apart; No. 2 shows them only 5 feet 10 inches apart, which still leaves ample clearance between the rod and the wheel. Thus, from 2¼ to 2¾ inches might have been gained on the great length of the steam-channels, which would materially have increased the firmness of the attachment of the cylinders.

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* Journ. Frank. Insti., Vol. XIX. p. 151.

I show dotted lines from the centres of both cylinders to the centres of the bolts by which they are held to the frame. No. 1 is held by one row; No. 2 by two rows, one above and one below the centre. No. 1 rests against the frame by a flanch just broad enough to admit of the bolt and its nut, for which three inches bearing surface is sufficient. No. 2 has a large bearing base of some 18 inches depth. The flanch in No. 1 might have been increased to reach near the top of the frame, the leg of the smoke box brought a few inches lower down, and then a double row of bolts, one of 5, the other of 4—a total number of about half those now used for this double purpose—would have produced a far firmer and more solid attachment. We must seek for a very firm support to the cylinder, for there is a great strain acting at its centre.

Cæteris Paribus,—the horizontal position of the cylinders in No. 1 is preferable to the inclined position in No. 2. American engineers know this, and admit it. But at what a sacrifice is this advantage gained? For the answer, I refer to the side elevations of the machines. No overhanging weight, the engine stands firm as a rock; with the use of the truck, all straining in curves is avoided. The truck does not admit of large leading wheels. Such small wheels in the English engine, with only one leading axle, would, at great speeds, be unsafe. But while in the American engine the velocity of the axle is increased, only one-half the weight is placed upon it, so that the straining is still even less.

As to the performance of the two engines, I am unable to institute a comparison. They are built for different purposes: No. 1 for speed, No. 2 for power. They are about the same weight: No. 1 is stated to weigh 21 tons; No. 2 weighs about 22 tons. The accounts of performance of the tank engine are too vague to found any comparison upon them.

The truck I have shown under No. 2 is not the one placed under her. It is one lately designed by the same engineer, and already placed under various engines. It is made of wrought iron and boiler plate, with cast iron gudgeons for the centre pin, and its construction will be readily understood from the drawing.

The iron framing in front of the engine is necessary on American lines; they being nowhere fenced in, and cattle frequently abounding in the adjoining fields. They are even called cattle-fenders or cow-catchers. They are the more necessary, as the fire-box, with its ash-pan, reaches so much lower down than in coke engines. Stretching across the whole breadth of track, they clear it most effectually; far more so than the life-guards used in Europe. Certain it is, that on this cattle fender coming in contact with a car, the demolition is more complete; but we must weigh the disadvantage in this case, which can only arise from negligence and the want of proper signals, with the advantages in cases over which there is no control; which, from the want of fences, and the sharpness of curves, may in America be more frequent.

There is one feature in American locomotives which must be deprecated, and wherein the English engine has the advantage; that is, the too frequent use of cast iron. In many cases, but chiefly where its power to resist compression comes into action, cast iron is greater value than wrought; but wherever it is subject to lateral strains or to torsion, it ought not to be used. I have seen what to English engineers will seem scarcely credible, even rocking-shafts with the levers cast on,—pieces of cast iron of great size and weight, to resist the strains. The high price of the material, and the excessive wages, have led to a more frequent adoption of this brittle material than otherwise would probably have been the case. While the general rate of traveling was slower than in England the evil was not so great. But now, when the speed of from 40 to 60 miles an hour is being introduced, we shall gradually see cast iron less used. Nearly all engines have cast iron jaws for the axle-boxes. The engine No. 2 shows them. To avoid these, the builder designed that admirable wrought iron one, shown in fig. 1, p. 220,* which has since been placed on an engine of the same class on the same road.

These various sketches of frames will show the almost universal use of adjusting keys or wedges for the axle-boxes. I not only think that this plan is better than trusting entirely to accuracy of workmanship, (it may scarcely occur once in fifty cases, still I have known an engine out of a renowned workshop in which the driving-axle was not square with the frame, and the extreme thinness of the box, only $\frac{9}{16}$ths of an inch, rendered planing off and packing impossible, thus causing great expense for the alteration,) but it provides the means for taking up any play which in time may take place from wear.

Cast iron wheels, even 6-foot drivers, are admirably made here. The details of proportions I shall give at a future time, when I propose to give an investigation into the relative merits of the "link" and American expansive motion, for which a series of experiments are now making; also details of construction of various parts, with illustrative drawings.

New York, March, 1850.

AMERICAN PATENTS.

List of American Patents which issued from September 17, *to October* 8, (*inclusive*,) 1850, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office*.

SEPTEMBER.

35. For an *Improvement in the Process of Working Gutta Percha;* Samuel T. Armstrong and Charles J. Gilbert, City of New York, September 17.

"The nature of our invention consists in the use of lime or other alkali with heat, to neutralize the acids contained in native or crude gutta percha, and thus preserve and render more permanent its useful properties.

"Our invention also consists in compounding lime with gutta percha, for the purpose of improving its qualities and preserving it wholly or partly from deterioration, and protecting it against the action of heat and the atmosphere."

Claim.—"What we claim as our invention, under the first part of our invention, consists in the use of lime or other alkaline substance with heat, in the manner substantially as herein described, in the cleansing of gutta percha, to neutralize the acid or acids con-

* Journ. Frank. Insti., Vol. xix. p. 151.

tained in that substance in its crude or native state, and thus preserve and render more permanent its useful properties, as specified.

"And in the second part of our invention, we claim compounding lime with gutta percha, substantially as herein described, for the purpose of improving its qualities, preserving it wholly from deterioration, and protecting it against the injurious effects of the atmosphere and heat, substantially as described."

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36. For an *Improvement in the Process of Preparing Cream;* Charles Denison Birdseye, City of New York, September 17.

"The nature of my invention consists in placing a quantity of pure milk in a vessel which is placed in a vapor bath, said vessel having a close cover with a pipe attached, which shall convey the steam and flavor arising from the evaporation of the milk through another vessel containing sugar, thereby preserving the pure flavor of the milk; the evaporation to be continued until the quantity is reduced about one-half, when the sugar is to be mixed in the milk, and the evaporation continued in an open vessel, (the same being constantly stirred,) until the whole becomes granulated, when it is dried sufficient to be reduced to a powder. The quantity of the sugar may be varied as desired."

Claim.—"What I claim as my invention is the process described herein, of distilling milk, and condensing the same in sugar, for the purpose of preserving the flavor, as set forth."

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37. For *Improvements in Spike Machines;* William Blake, Boston, Massachusetts, September 17.

Claim.—"I claim the heading and carrying nippers, in combination with the shears, the header, and the griping mechanism; the same being made to operate in connexion therewith, substantially as specified.

"And in combination with the lower nipper, I claim the spring catches, latching and unlatching apparatus applied to it, for the purpose specified."

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38. For an *Improvement in Machinery for Ginning or Picking Cotton;* Francis Alton Calvert, Lowell, Massachusetts, September 17.

"The nature of my invention consists in an improved machine for picking cotton: that is, in a machine by which the fibres of cotton are torn from the seeds, and from any other extraneous matter which may be mixed with them, whereby the separated fibres are less broken after the operation of such picking than is the case with machines which have heretofore been used for the same purpose."

Claim.—"What I claim is the combination of such parts as I have shown, forming a picking machine, and their mode of action, as hereinbefore described."

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39. For an *Improvement in Processes for Preparing Wheat for Grinding;* Joseph W. Carpenter, Pontiac, Oakland county, Michigan, September 17.

"The nature of my invention or discovery relates to treating of wheat and other grains with an acid or a mixture of acids, to remove humidity from the grain, and make the skin or hull more easy of separation from the flour or starchy part of the grain with a less pressure of the mill stones in reducing the grain to flour or meal; thereby producing a greater amount of fine meal or flour from a given quantity of grain, (about seven per cent.,) also giving to the grain, for storage or carriage in vessels, greater preservative qualities."

Claim.—"I claim the application of an acidulous composition to wheat or other grain, the said composition being principally vinegar; but I do not limit my claim to the exact composition of acids as herein described while the same effects can be produced by the vinegar alone, or when combined with one or more of the other acids, especially with the sulphuric acid, for the purposes set forth."

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40. For an *Improvement in Paper Filers;* William A. Collord, Cincinnati, Ohio, September 17.

Claim.—"What I claim as new, are, 1st, the arrangement and construction after the manner substantially as described, of a box or receptacle for documents or papers, having a lid fitting loosely within it, which is made to press down upon the papers by a spiral or other suitable spring.

"2d, The rod or its equivalent attached to the lid, and moving in the guide slits or apertures in the sides of the box, the said slits terminating in a notch or shoulder at their upper extremities, for the reception and retention of the rod during the manipulation and examination of the file."

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41. For an *Improvement in Grain Harvesters;* Ebenezer Danford, Jr., Geneva, Kane county, Illinois, September 17.

"The nature of my invention consists in the application of two sickles to a reaping and mowing machine, working together in opposite directions at the same time, so as to throw the weight of the moving parts upon opposite sides of the centre of the crank orbit."

Claim.—"What I claim as my invention, is the application to a reaping and sowing machine of two sickles, working together in opposite directions as set forth, so as to throw the weight of the moving parts upon opposite sides of the centre of the crank orbit, for the purpose set forth."

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42. For an *Improvement in India Rubber Hose;* Horace H. Day, Jersey City, New Jersey, and Richard McMullen, Great Barrington, Berkshire county, Massachusetts, September 17.

"The nature of our invention consists in forming water-tight and durable hose from India rubber and fibrous substance, so arranged as to impart strength, and yet prevent mildew to the fibrous substance, which is the source of decay to other kinds of rubber hose."

Claim.—"What we claim as our invention, is the making of flexible hose or pipe, by combining India rubber leather with a tube of rubber, substantially as herein described, the whole being united, forming one solid tube, making a strong, durable, and flexible hose, adapted as a substitute for leather and other similar pipes for the conveying of fluids."

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43. For an *Improvement in the Plough Clevis;* Gerrett Erskon, Hobart, Delaware county, New York, September 17.

"The purpose of my invention is to guide and direct the movement of plough beams in such manner as to make the depth of the furrow and its breath, conform to the requirements of the land to be tilled."

Claim.—"What I claim as new, is so making a clevis with teeth or prominences and cavities on the front surface of a socket, matching with corresponding depressions or cavities and elevations on the surface of a movable bar, that the bar and socket when set together by a screw, or other equivalent fastening, in the required position, may have numerous bearings, and be wholly prevented from either sliding or revolving in any direction, without breaking the continuity of materials, of which the parts are composed.

"I also claim in combination with a series of radial ridges, or a circle of cavities on the end of a clevis socket fixed at the extremity of the plough beam, a series of teeth or of conical points on a movable clevis-bar, so adjusted to each other, that the guide-hole of the clevis-bar may be held in any required position, and at any necessary distance from the axis of the beam without relying on friction of the surfaces to prevent slipping, in the manner and for the purposes herein set forth.

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44. For an *Improvement in Printing Machines;* John B. Fairbank, Leon, Cattaraugus county, New York, September 17.

"The nature of this invention consists in arranging within a suitable case a series of sets of inclined wires or rods, attached to bent plates at their upper ends, upon which rest keys. The keys, plates, and wires being supported by coiled springs, each set of wires being brought within a small compass at the bottom, and having type upon their lower ends, marked with characters indicating letters, and sounds of letters, and capable of being inked and pressed against a sheet of paper, either singly or in connexion with others—by pressing on said keys. The keys working changes upon the type. I use in our machine forty-eight entire and separate alphabets. Each of which comprises a vowel and a consonant alphabet, separate and distinct from each other. In writing, I use a vowel alphabet for every vowel character printed in a line upon the paper, and a consonant alphabet for every consonant character in one line. Each vowel alphabet has fifteen keys, and their attachments by which changes are wrought upon five wires, and their attached type, to make either of the fifteen vowel characters. And each consonant alphabet has twenty keys and their attachments—working changes upon six wires or type for making either of the consonant characters used.

"In writing, letters or sounds indicated by characters, are selected from the various alphabets—one letter from each. The characters upon the keys taken, expressing the sounds of the words written, observing to select the alphabets in the order in which the sets of type (the five and six type forming one set) are arranged above the paper (one-eighth inch from it.) At the end of every line written, the ink-roller is forced under the type, and the paper-carriage moved by the foot or hand."

Claim.—"What I claim as my invention, is the mode of representing letters, and the sounds of letters, by means of characters made by changes wrought upon a less number of movable type than the number of letters or sounds of letters represented. The type being made upon, or attached to the bottom of wires or rods which are worked by keys, at or near the top, substantially as herein set forth."

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45. For an *Improvement in Corn Shellers;* Samuel L. Graves, Springfield, Sangamon county, Illinois, September 17.

"My process of stripping the grains of corn from the cob, consists in forcing the ears separately between a set of shelling plates, while, at the same time, they are twisted on their axes."

Claim—"What I claim as my invention, is the device herein described for twisting and forcing the ears of corn between spring shelling plates, substantially as herein set forth."

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46. For an *Improved Tool for forming Plaster Cornices and Mouldings;* Sylvester Groesbeeck, City of New York, September 17.

"My invention consists in arranging the mould or former in a square frame, at an angle of 45° with the sides of the square, or, in other words, upon the diagonal of the square of the frame containing the mould, by which arrangement, provided the angles of the room upon which the moulding is to be placed are all at right angles or angles of 90°, it is only necessary for the moulder upon reaching the angle, to place the adjacent side of the square upon the walls, and continue as before."

Claim.—"What I claim as my invention, is arranging a former for making mouldings upon the walls and ceilings of a room, upon the diagonal of a square frame, and making an angle of 45° with each side of said square, for the purpose and in the manner described."

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47. For an *Improvement in Daguerreotype Plate Holders;* George Mallory, City of New York, September 17.

"My invention consists of a single block to which the Daguerreotype plate is securely clamped by one or more springs secured to the sides or ends of the block, in such manner that all the operations to which the plate is subjected by the Daguerreotyper, can be effected without removing the plate from the holder, while at the same time the plate is quickly and readily either clamped to, or removed from, the face of the block."

Claim.—"What I claim as my invention, is the Daguerreotype plate-holder, constructed substantially as herein described, of a block with a spring edge, by which the plate is secured to it."

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48. For an *Improvement in Spring Beams to Ploughs;* William Morrison, Carlisle, Cumberland county, Pennsylvania, September 17.

"My plough is of that class known as gang-ploughs, and my invention consists in a spring draft-bar to which the team is hitched, and in the method of attaching the plough-irons to their respective beams."

Claim.—"What I claim as my invention, is, 1st, the adjustable spring-bar interposed between the point of draft and the frame of the plough in the manner, and for the purpose herein set forth."

49. For an *Improved Roadway for Rail-Cars and ordinary Vehicles;* Jordan L. Mott, Mott Haven, Westchester county, New York, September 17.

"The nature of my invention consists in making the rails each with a curved, or trough-like projection outward and downward from the upper and outer edge of the rail, and in combination therewith, to the level of the edge of which projections the road-way is to be paved; the said projections of the rail being a gradual curve or inclined plane from the upper edge of the rail, that the wheels of common carriages may pass over the rail with facility, and when running thereon, may have a tendency, by reason of the inclined or curved face, and the weight of the carriage to descend from the rail; and thus, at the same time, keep the other from the inner edge of the other rail, if the gauge of the carriage be the same, or nearly the same, as that of the rails; and if it be of a wide gauge that the two wheels in running thereon, may straddle the rails, and run on the outside of both.

"My invention also consists in making the inner edge of the rail with an inclined, or trough-like projection, in combination with the above mode of making the projection on the outer edge."

Claim.—"What I claim as my invention, is the method substantially as herein described, of making rails for the roadways of streets, &c., by combining with the rails on which flanched car wheels run, outer faces of sufficient breadth for the wheels of common carriages to run, made curved or inclined from the top of the rail, substantially as described.

"And in combination therewith, I also claim making wide faces on the inside of the rails substantially as described, for the wheels of common carriages to run on, as described."

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50. For an *Improvement in Cast Iron Rail Road Car Wheels;* Benjamin Severson, Schenectady, New York, September 17.

"The nature of my invention consists in having the sides of the hollow part of the wheel symmetrical in form and amount of metal, having an equal amount of surface internally and externally, thus insuring an equal amount of contraction in cooling, having the sides united in one thickness of plates at points nearly equidistant from hub and tread. And the parts adjacent to these plates united to them in the form of pointed arches, the parts between these plates raised so as to give the wheel sufficient lateral strength; and these raised parts will take nearly the form of hollow arms, having their radial sides curved inward or toward each other, and not have any portion of them bulged or curved outward, thus having all parts well bound together, giving the whole a great amount of lateral strength, to resist wrenching, and yet all parts of the metal nearly in the direction of the stress or force acting upon them."

Claim.—"What I claim as my invention, is a cast iron wheel in one piece, having the rim connected to the hub by two plates joined together at intervals, at points as small as may be, and nearly equidistant from the rim and hub—said plates being of such form, that each section by the plane of the axes, passing through the points of union, shall present two pointed arches, uniting at the apex, the one springing from the ends of the solid hub, and the other from the edges of the rim; and a similar section between the points of union, shall bestow flat curved lines bending towards each other, and joining the ends of the solid hub with the edges of the rim; and a circular section passing through the points of union of the two plates, shall produce a double series of flat arches, united to each other at their ends. The whole being constructed substantially in the manner and for the objects set forth."

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51. For an *Improvement in Sewing Machines;* John Bachelder, Boston, Massachusetts, September 24.

Claim.—"What I claim as my invention, is the machinery herein described for making the stitch, viz., the combination of the hook, the plier, and needle, as constructed and made to operate together, substantially as described."

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52. For *Improvements in Looms for Weaving Tapestry and Brussels Carpets;* Erastus B. Bigelow, Clinton, Worcester county, Massachusetts, September 24.

"The nature of my invention, is causing the movable guides and supports—which have a vertical movement—to open and close, so that the wire shall be introduced when they are closed, to insure the introduction of it in a proper position, and when in place, that it may be liberated by the opening of the guides or supports.

"And the second part of my invention consists in the employment of a stop motion to be operated by the wires as they are introduced, so that when the wire fails to be introduced, the loom shall be stopped."

Claim.—"What I claim as my invention, is closing and opening the supports or guides as they are raised and depressed to receive and support or guide the wires, and to liberate them in manner substantially as herein described."

"And I also claim the employment of a stop-motion in looms for weaving looped or piled fabrics, in which the pile is formed on wires for the purpose of stopping the loom whenever a wire fails to be introduced, substantially in the manner described."

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53. For an *Improvement in Processes for Refining Gold;* James C. Booth, Philadelphia, Pennsylvania, September 24.

"The nature of my invention consists in the preparation of a solution of gold, alloyed with silver or other metals, so as to convert them into chlorides; and a precipitation of metallic gold upon the chloride of silver and other insoluble chlorides; and in the subsequent reduction and extraction of the silver or other metals from those insoluble chlorides; or the direct extraction of their chlorides by solution in the manner hereinafter set forth, so as to leave the gold pure."

Claim.—"What I claim as my invention, is, 1st, the process of dissolving alloyed gold for refining it, by developing nitric acid, or both nitric and muriatic acids gradually from their salts, in the manner, and for the purpose set forth in the specification.

"2d, I claim the process of precipitating gold from its solution, and removing therefrom the insoluble chlorides, as set forth.

"3d, I claim the process of refining alloyed gold without the use of silver, so as to form a solution of gold and other metals, and a residue of chloride of silver and of other insoluble chlorides, and then precipitating metallic gold upon those insoluble chlorides in the same vessel without transfer after the solution is effected; and afterwards dissolving out the insoluble chlorides from the gold; or reducing the insoluble chlorides to the metallic state in the wet way, and dissolving out the metals from the gold, all in the manner hereinbefore described.

"4th, I claim the process as described of dissolving alloyed gold in wooden vessels, which may be made of any dimensions, corresponding to the extent of the operation.

"5th, I claim the process as described of dissolving alloyed gold, by blowing steam directly into the solvent liquids, all in the manner as hereinbefore described."

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54. For an *Improvement in Grain Cleaning Machines;* George W. Bowers, Leitersburgh, Washington county, Maryland, September 24.

"My invention is based on the fact that garlic is softer, and can be much more easily compressed than sound wheat with which it is mixed. I therefore present the wheat to be cleaned to the face of a revolving barrel, formed of staves, having flaring slots between them sufficiently large at the outer faces of the staves to receive the grain, but small enough at the inner faces of the staves to prevent its passage between them. The grain in the slots is subjected to the pressure of the teeth of one or more series of wheels, by the action of which the smutty grains are crushed, and the garlic compressed and pushed through the narrow opening of the slots into the hollow centre of the barrel, and discharged through openings in its head, at the side of the machine. By the revolution of the barrel, the good wheat is discharged from the flaring mouths of the slots into a funnel beneath the barrel from which it is delivered in a thin sheet, upon an inclined plane down which it runs to be discharged from the machine; during the delivery of the grain from the funnel, and its passage down the inclined plane, it is subjected to a strong current of air produced by a fan attached to the machine, and all dust and dirt are expelled."

Claim.—"What I claim as my invention, is the combination of the revolving slotted hollow barrel with the toothed wheels, the same being arranged and operated substantially in the manner, and for the purpose herein set forth."

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55. For an *Improvement in Machines for Fumigating Plants;* David Stephens Brown, Old Kent Road, county of Surrey, England, September 24; anté dated September 13, 1849.

Claim.—"I claim the combination in apparatus or instruments for fumigating purposes of a destroying magazine, containing the fumigating or obnoxious substance, with a cylinder and exhausting fan or wheel, whereby the smoke is drawn in at one part of the cylinder, and driven out at another; and whereby also the atmospheric air necessary for the combustion of the substance is drawn into it by the said fan or wheel, both as before described."

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56. For an *Improvement in Machines for Making Ropes;* Henry Evans, New Bedford, Massachusetts, September 24.

"My invention consists in supporting the frame of the gears and strand spindles on the main laying shaft alone, and combining with the said frame and the main frame of the machine suitable machinery, whereby the said frame of the gears and strand spindles may be either clamped to the main frame, or so fastened as to be prevented from revolving, while the main laying shaft and strand spindles are in revolution on their respective axes, or be unclamped, or unfastened, as occasion may require, and for the purpose of enabling the strand to be laid or twisted together, without previous removal from their spindles, as will be hereinafter more particularly explained."

Claim.—"What I claim as my improvement, is to support the frame of the gears and strand spindles on the main laying shaft alone, and combining with the said frame and the main frame of the machine the lever or suitable machinery whereby the said frame of the gears and strand spindles may be either clamped to the main frame, or so fastened as to be prevented from revolving, while the main laying shaft and strand spindles are in revolution on their respective axes, or be unclamped or unfastened therefrom as occasion may require, and for the purpose of enabling the strands to be laid or twisted together without previous removal from their spindles, as heretofore practised and above described."

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57. For an *Improvement in Stop-motion of Looms;* Elijah Hall, Cabotville, Hampden county, Massachusetts, September 24.

"The nature of my invention consists in allowing the lower end of the reed to hang free until the lathe arrives within a short distance of putting in the filling, when it is securely held in a position for filling by means of a movable bar passing across the back of it, and attached by arms or brackets to a shaft working in bearings attached to the under side of the lathe; the said movable bar being fixed by two snecks on the ends of two arms of levers passing through the lathe, and working on centres attached to the front of the lathe, being operated by coming in contact with a spring attached to the breast beam of the loom. The reed is so hung, that in consequence of any obstruction in throwing the shuttle it will be freed entirely from the movable bar as the lathe moves forward."

Claim.—"What I claim as new, is the manner herein described, of securing the movable reed-bar and reed while the filling is being put in, and releasing them after the filling is completed, by the combination of the levers having arms and snecks, and the springs; the whole being arranged and operated in the manner, substantially as herein set forth."

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58. For an *Improvement in the Construction of Threshing Machines;* Darius W. Harris, Yorkshire, Cattaraugus county, New York, September 24.

"My invention consists, 1st, in dispensing with what is usually termed the concave, and in substituting a toothed cylinder in its place; 2d, in constructing the toothed cylinders of annular sections, which are arranged upon shafts in such manner, that when the teeth of any one section meet with any obstruction which they cannot break, that section ceases to revolve while the others continue to act."

Claim.—"What I claim as my invention, is the threshing cylinders, constructed of fast and loose sections; the fast sections of one cylinder being opposite the loose sections of another, substantially as herein set forth."

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59. For an *Improvement in Burning Fluids;* Ephraim Howe, Brooklyn, New York, September 24.

"The nature of my invention or discovery consists in compounding the flour of rosin, and the essential oils obtained by distilling whiskey or other liquors from grain or other vegetables; such essential oils being the residuum of whiskey or other liquors, after the same is distilled or rectified."

Claim.—"What I claim as my invention, is the compounding rosin and the essential oil of vegetables or grain, (when the same is produced by distillation of whiskey or alcoholic liquors, and thereby become a refuse article,) for the purpose of making a material from which to make gas. Also for a burning fluid as set forth herein, whether compounded in the precise proportionate quantities set forth, or other quantities which will produce substantially the same result, all of which is fully set forth herein."

60. For an *Improvement in Machinery for Drawing Hemp and Parting its Fibres;* O. S. Leavitt, Maysville, Kentucky, September 24.

"The object of my invention is to reduce the fibres of slivers of flax or hemp to a nearly uniform length, by breaking the long fibres contained in such slivers, and to this end, the principle or character of my invention, which distinguishes it from all other things before known, consists in combining a rotating cam or cams with two sets of holding fluted rollers, between which the sliver or slivers pass, and by which it or they are held; the second set of fluted rollers, which deliver the said sliver or slivers, being geared to rotate with greater velocity than the first set."

Claim.—"What I claim as my invention, is the employment of two sets of holding and drawing rollers, substantially as herein specified, in combination with a rotating cam or cams, or the equivalent thereof, for each sliver, in the manner and for the purpose substantially as described."

61. For an *Improvement in Casting Stereotype Plates;* Jason M. Mahan, Philadelphia, Pennsylvania, September 24.

"The nature of my invention consists in providing a dipper composed of iron, brass, or other material, to be used instead of the common dipping pan. This dipping pan is composed of several parts, and so constructed as to receive the moulds in a vertical position, or nearly so, with the face of one mould towards the back of another, by which mode any desired number of plates may be cast at the same operation, or at any one operation, being limited only by the number of moulds, the quantity of metal employed, the capacity of the melting pan, and the size and capacity of the dipper."

Claim.—"What I claim as my invention, is the employment of the dipper, constructed substantially as described, in the vertical casting of stereotype plates, in the manner herein set forth."

62. For a *Process of Reducing Gold Bullion;* Richard S. M'Culloh, Princeton, New Jersey, September 24.

"The nature of my invention and discovery consists in bringing gold bullion, containing silver or other impurities, into a loose, divided, pulverulent, or spongy state, texture, or disintegrated molecular condition, so that all impurities it may contain can readily be removed by acids."

Claim.—"What I claim as my invention and discovery, is, 1st, the reduction of argentiferous and other gold bullion, as a preparatory process in the art of refining thereof, into a pulverulent or spongy state, or a disintegrated molecular condition, by the means, particularly of fusion therewith, and the subsequent removal by acids therefrom, of zinc or other metal baser than silver, which will produce the desired effect, for the purpose of then separating by acids, from such gold bullion, the silver and other impurities which it may contain, without quartation with silver or any intermediate process, in order to fit the gold for coining and other uses.

2d, I also claim, in addition to the above processes, the pulverising by grinding, crushing, or percussion, of gold bullion rendered brittle by union with lead, solder, or other like base metal, for the purpose set forth.

63. For *Improvements in Removing Electricity from Wool in the Process of Manufacture;* Joseph Metcalf, Worcester, Massachusetts, September 24.

"My improvement in the woolen manufacture consists in the discovery of a method of preventing the divergence of the fibres of the wool by electricity, without the employment of oil for that purpose; this method consists in the removal of the electricity from the wool by suitable conductors which may be formed and arranged in various ways to suit different circumstances."

Claim.—"I claim as my improvement in the manufacture of wool, the removal of electricity from its fibres, substantially in the manner and for the purpose herein set forth, but irrespective of the form, arrangement, or construction of the apparatus by which such removal of electricity is effected."

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64. For an *Improvement in Heating Elevated Ovens;* P. A. Palmer, Le Roy, Genesee county, New York, September 24.

"The nature of my invention consists in the arrangement of revertible flues in elevated ovens; secondly in the arrangement of a grate in the four-boiler-hole elevated oven stove, so as to build the fire under the back boilers and nearer the oven for summer use, requiring less fire to heat the oven and two boilers than when the fire is made in the front part; and lastly, in the manner of making oven grates, so that they may be drawn nearly out of the oven, and support themselves with the weight of articles that may be placed upon them for baking."

Claim.—"What I claim as new, is the arrangement and combination of revertible flues in elevated ovens of cook stoves, in the manner and for the purpose described."

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65. For *Improvements in Machinery for Fulling Cloth;* Charles A. Read, joint inventor with, and assignee of, Thomas Cotter. New Hartford, Oneida county, New York, September 24.

"The nature of our invention consists in fulling fabrics by means of toothed cylinders operated by power machinery."

Claim.—"What we claim as our invention, is the above described mode of fulling fabrics by means of toothed cylinders by power machinery, the fabric being fed between the fulling toothed cylinders by means of feeding rollers, through guides, with sufficient rapidity to prevent all strain upon the fabric, and at the same time to supply the fulling cylinders which receive the fabric, full it, and then pass it out between two cleaning rollers, which receive it from the fulling cylinders prepared for other processes. The movements of the several parts of the machine being produced by a combination and adjustment of mechanism similar to that herein described, or any other which may be substantially the same, and by which analogous results may be produced."

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66. For an *Improvement in Water Wheels;* Timothy Rose, Cortlandtville, Cortlandt county, New York, September 24.

Claim.—"What I claim as my invention, is making the discharge aperture of the shutes movable relatively to the axis of the wheel, or the axis of the wheel movable relatively to the aperture of the shute, substantially as described, for the purpose of varying the effective diameter of the wheel, and thereby increasing or decreasing the velocity thereof, substantially as described."

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67. For an *Improved Machine for Forming and Charging Percussion Caps;* George Wright, Washington City, D. C., September 24.

Claim.—"What I claim as new, is, 1st, the combination of the several motions given to the sheet of metal, by which it is presented to the cutting punch by an intermittent motion from right to left, and *vice versa;* and when the edges are reached reversing the direction, and at the same time advancing the sheet, so that the blanks are punched in successive rows across the sheet, substantially as set forth.

"2d, I claim the chisel moving with the punch stock, by which the perforated sheet is cut into strips for removing it piecemeal from the machine, substantially as described.

"3d, I claim giving such a form to the slots of the carrying plate that the caps, when lifted from the shaping die, are caught by them and taken on, substantially as described.

"4th, I claim, in combination with the slots of the carrying plate, the conducting groove, by which the caps are guided transversely in the slots, and made to present themselves accurately under the charger and polisher, and to drop out when completed, through holes at the end of the slots, substantially as described.

"5th, I claim operating the cap-holder and the revolving polisher or pressing punch by a single cam, in connexion with the strong and weak spring, substantially in the manner and for the purposes set forth.

Lastly, I claim the combination in one automatic machine of the several processes, by which the percussion caps are cut out of a sheet, shaped, charged, and the charge polished down, substantially in the manner described."

RE-ISSUES.

1. For an *Improvement in the Manner of Constructing the Truss Frames of Bridges and other structures;* William Howe, Springfield, Massachusetts; patented August 3, 1840, re-issued September 3, 1850.

Claim.—"What I claim as my invention in the construction of truss frames, is the method of uniting the upper and lower stringers without attaching them to the interposed timbers, by the combination of the straining blocks, with the timbers interposed for keeping the stringers apart, and the tension rods for drawing them together, substantially as described, whereby the camber can be regulated with facility along the whole or any portion of truss, as described."

2. For an *Improvement in Stoves;* Anson Atwood, Troy, New York; patented May 14, 1850, re-issued September 17, 1850.

Claim.—"What I claim as new, is the air chamber in which the air is heated previously to its admission to the fuel, in combination with the aperture by which the heated air is caused to impinge on the upper surface of the fuel, substantially in the manner and for the purposes as described."

3. For an *Improvement in Brick Presses;* Isaac Gregg, Philadelphia, Pennsylvania; patented June 6, 1848, re-issued September 17, 1850.

Claim.—"What I claim as my invention, is the making of the moulds of extra depth, in combination with the elevation of the bricks in the moulds, after they have been pressed a distance equal to the extra depth given to the same, and the removal of the surplus thickness of the bricks, (raised above the tops of the moulds,) by a knife or its equivalent, for the purpose of giving uniform solidity and perfection of form to the bricks prior to their final removal from the moulds, substantially as set forth."

4. For an *Improvement in Printing Presses;* Stephen P. Ruggles, Boston, Massachusetts, patented November 10, 1840, re-issued September 17, 1850.

Claim.—"I claim a platen raised and lowered by machinery, substantially as described, in combination with the movable tympan plate on which the sheet of paper is placed, and the bed supporting the type with their faces downwards; the whole being arranged and operating together substantially in the manner and for the purpose set forth.

"I claim supplying the press with paper, and removing the same after it is printed, into a box attached to the tympan carriage, by means of a vibrating table, operated by a cam a on the shaft I, in combination with a frisket constructed as described, connected to the frame of the tympan plate, and pressed down upon said plate by a spring, and raised when the tympan carriage recedes with the printed sheet, by means of a cam o' on the shaft I, through the intervention of a bar with a roller, shaft y', and angular piece of metal; the whole being arranged and operating together substantially as set forth.

"I claim grooving or channelling the fountain roller, or plate under the same, in the manner and for the purpose mentioned.

"I claim the peculiar combination of machinery for the lateral vibration of the distributing roller, said combination consisting of the pulleys r^2 on the shaft B, band, pulleys x^2, rod y^2 z^2, lever, rod e^3 f^3, shaft g^3, and distributing roller frame; the whole being arranged and operating together substantially in the manner and for the purpose mentioned.

"I claim the use of the side strips and cross strips, or either of them, in combination with a tympan supported by the platen plate, the said combination forming a pair of nippers, as it were, for rigidly holding the sheet, however small the margin may be, until it is effectually free or disengaged from the form after an impression is produced."

ADDITIONAL IMPROVEMENTS.

1. For an *Improvement in Tailors' Measures;* Amos Stocker, Ogdensburgh, St. Lawrence county, New York; patented May 28, 1850, additional improvement annexed September 3, 1850.

Claim.—"What I claim in these letters patent additional, in the combination of the socket and rule, fig. 6, 7, with the instrument represented at fig. 2; also the socket in the arms 6 7 as represented; also the manner of connecting the two instruments together by bar P P, for the purpose of ascertaining the slope of both shoulders at one operation; also the additional width of the lower arm, and the combination of the groove and slide R S, and rule X, with the lower arm, as represented at O 8, as set forth."

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2. For an *Improvement in Apparatus for Splitting and Stretching Leather;* Bradford Rowe, Albany, New York; patented April 30, 1850, additional improvement annexed September 10, 1850.

Claim.—"I claim the improvement of the apparatus for splitting and stretching leather, secured to me by letters patent in April, 1850, by adding thereto an additional apparatus for stretching leather, especially belting; said apparatus consisting of the combination of two rods placed one above the other in juxtaposition, the upper rod maintaining two clamps to hold the leather to be operated on, the one clamp fixed to one end of the rod, the other clamp movable along the rod; the said rod being separable from the machine with the leather, after the same has been stretched, for the purpose of allowing the repetition of the stretching operations with another similar rod and another piece of leather; the under rod to be a permanent attachment to the machine, but movable along its own length, by the wheel-work of the machine or otherwise, so that when the upper rod is temporarily secured to it by one end near the fixed clamp, and the other clamp is held in its position, the two clamps may be gradually separated, stretching the leather lying between them, substantially as set forth."

DESIGNS.

1. For a *Design for Bust of Daniel Webster;* John C. King, Boston, Massachusetts, September 17.

Claim.—"What I claim is the design of a bust of Daniel Webster, as represented."

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2. For a *Design for a Blower Stand;* Walter Bryent, Boston, Massachusetts, September 24.

Claim.—"What I claim is the new design described for a blower stand, consisting in forming the two halves of said stand in the form of an ancient lyre frame, ornamented with volute scrolls, as set forth."

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3. For a *Design for Plates for Registers, Ventilators, &c.;* Charles F. Tuttle and James S. Bailey, Williamsburgh, Kings county, New York, September 24.

Claim.—"What we claim is the particular configuration or design of open scroll or fret work, substantially as described."

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4. No. 2.—Title and claim same as the above.
5. No. 3. " " "
6. No. 4. " " "
7. No. 5. " " "
8. No. 6. " " "

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9. For a *Design for Stoves;* Learned & Thatcher, assignees of Reuben J. Blanchard, Albany, New York, September 24.

Claim.—"What I claim is the designs and ornaments, consisting of cornucopias and fruits issuing from them, and of vines and leaves issuing from scrolls, as described."

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10. For a *Design for Stoves;* Joseph G. Lamb, Cincinnati, Ohio, September 24.

Claim.—"What I claim is the combination and arrangement of the shapes, figures, ornaments, flutes, and mouldings, into the above represented style and design for coal heating stoves, substantially as shown."

11. For a *Design for Stoves;* Joseph G. Lamb, Cincinnati, Ohio, September 24.

Claim.—"What I claim is the combination and arrangement of the mouldings, shapes, figures, and ornaments, into the design for cooking stoves, substantially as shown."

12. For a *Design for Stoves;* William Savery, New York, September 24.

Claim.—"What I claim is the peculiar combination and arrangement of the several ornamental figures and mouldings forming the original design of this stove, as described."

OCTOBER.

1. For an *Improvement in Wrought Iron Car Wheels;* Herrick Aiken, Franklin, Merrimac county, New Hampshire, October 1.

Claim.—"What I claim, is the combination of the rim with the arms at the ends of the spokes, by means of the inner flanch, and bevel between the flanch and opposite side of the rim."

2. For an *Improvement in Cotton-stalk Harvesters;* Stephen Bowerman, Detroit, Michigan, October 1.

"The nature of my machine consists in the construction of a frame of suitable width to pass between the rows or drills, and mounted on wheels for the purpose of being propelled by any power applied to it, which frame is also provided with two wheels, and attached to said frame by means of upright shafts, in such a manner as will allow them to revolve at ease—said wheels are provided with teeth attached to their rims, (not unlike large saw teeth,) these wheels are made of a sufficient diameter to project far enough from the sides of the frame to allow the teeth to come in contact with the stalks, which are extracted by the operation of drawing the machine between the rows or drills."

Claim.—"What I claim as my invention, is the combination of two saw teeth wheels with the frame, and supported thereby, and the triangular pieces of iron for disengaging the stalks, in the manner and for the purposes set forth."

3. For an *Improved Double Acting Rocker for Washing Gold;* Arnold Buffum and Philip Thorp, City of New York, October 1.

Claim.—"What we claim as our invention, is the combination of the movable pan with the gold washing rocker, so arranged and operated as to give to the pan inside of the rocker, a double rocking or vibrating motion, sidewise and endwise, substantially as described."

4. For an *Improvement in Mills for Grinding;* W. P. Coleman, New Orleans, Louisiana, October 1.

Claim.—"What I claim as my invention, is the elastic cushion inserted in the bottom of the socket of the cock-head, substantially in the manner and for the purpose set forth."

5. For an *Improvement in Slides of Seed Planters;* Robert J. Colvin, Lancaster, Pennsylvania, October 1.

Claim.—"What I claim as new, is the combination of the reversing slides with each other and the hopper, by which the machine can be readily adapted to different varieties of planting, in the manner and for the purposes set forth."

6. For an *Improvement in Vegetable Cutters;* Reuben Daniels, Woodstock, Windsor county, Vermont, October 1.

"My vegetable cutter is composed mainly of a hopper in which the vegetables are introduced, and of a curved reciprocating hopper bottom, which is furnished with a double edge knife, and is caused to move to and fro beneath the hopper, by means of suitable mechanical devices, in such manner that the substances introduced within the hopper are alternately acted upon by the opposite edge of the knife; the hopper is also fitted with removable cutter bars which support the articles introduced within it against the action of the knives, and which can be removed whenever the articles are of such size that they would be prevented by the bars from coming in contact with the moving bottom."

Claim.—"What I claim as my invention, is the combination of the double-edged reciprocating blade with the hopper and removable bars, for slicing vegetables, substantially as set forth."

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7. For an *Improvement in Looms;* William M. Chace, Boston, Massachusetts; assignee of Halvor Halvorson, Northampton, Massachusetts, October 1.

Claim.—"I claim the combination of the stationary circular plate, the gears, the circular box, with the tubular shaft, and the main shaft; the same being for the purpose of effecting the rotations of the cam shaft, without any such exposure of gears as is customary in most other looms, and which are not only often productive of accidents to attendants or workmen, but often destroy or injure the shuttles when thrown out of the lay by the action of the pickers.

"I also claim the combination of mechanism for operating the harnesses, when they are constructed substantially as specified, the said combination consisting of the supporting or radial bars of the harness frames, the rocker shaft and tubular shaft, the arm and its pin or stud which enters the groove of the cam, and the endless chain and fixed pulleys; the whole being applied together, and made to operate essentially as described.

"I also claim the mode of constructing each of the harness frames, viz., of a combination of a bar, and thread carriers, as applied together, and made to operate as described.

"I also claim the combination of an endless belt, and its projection or picker with each shuttle box and its picker staff, so as to constitute the floor or bottom of the shuttle box, and operate and be operated in manner as described.

"I also claim the combination of mechanism for operating each picker staff, the same consisting of the cord and pulley attached to it and the main frame, the spring of the foot of the picker staff, the spring latch on the lay, and the discharging cam or plane, affixed to one of the harness frames, the whole being as above described.

"I also claim the mode described of making the race beam, viz., with elevations or plates to extend above it, and between and above the lower warp threads, and so as to constitute a support for the shuttle in its passage over the race beam; the same enabling me to protect the yarns from injury from the shuttle, and to run the loom at a greater velocity than it would be safe to operate it with a race beam constructed in the ordinary manner."

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8. For an *Improvement in Rice Harvesters;* J. J. Herndon, Marlborough District, South Carolina, October 1.

Claim.—"What I claim as my invention, is the application of the vertical blade and wing attached to either or both sides of a beam, and their combination with each other, and the other parts of this machine, running by hand or horse power."

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9. For an *Improvement in Saw Gates;* Oliver B. Judd, Rockton, Herkimer county, New York, October 1.

Claim.—"What I claim as my invention, is raising and lowering the saw for the purpose of using the whole cutting part of the same."

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10. For *Improvements in Dash Boards for Carriages;* Lewis Lupton, Winchester, Virginia, October 1.

Claim.—"I claim the arrangement of the winch-shaped hand and foot lever, in combination with, and the attaching the same to, a jointed, moving, dash frame. Together also, with the attaching of said jointed, moving, dash frame to the running gear part of the vehicle, instead of to the body part of the vehicle, as is usual."

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11. For *Use of Rosin Oil in Printers' Ink;* Moses M. Mathews, Rochester, New York, October 1.

Claim.—"What I claim as my invention, is the employment of rosin oil in the manufacture of printing ink, substantially as set forth."

12. For *Improvements in Weavers' Shuttles;* William Murkland and Joseph Milnes, Lowell, Massachusetts, October 1.

"The first part of our invention consists in the arrangement and position of the lever forming one of the friction surfaces, by which arrangement, the irregular strain upon the yarn caused in ordinary shuttles, is to a great degree avoided.

"The second part of our invention consists in the construction and peculiar combination of the spring, which compresses the metallic friction surfaces upon the yarn."

Claim.—"What we claim is, 1st, the combination and arrangement of friction levers in weavers' shuttles, in such a manner that the lever shall be allowed to vibrate towards and from the bobbin, for the purpose of producing a more even tension, substantially as herein described.

"2d, The combination and arrangement of a spring and cam surface upon the friction lever, in order, that as the friction lever is raised from its seat, the compression may be made more or less as desired, substantially as herein described."

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13. For an *Improved Auger Handle;* Gelston Sanford, Ellenville, Ulster county, New York, October 1.

Claim.—"What I claim as new, is securing augers and other tools in their handles by means of a tube attached to the inner half of one part, and an eccentric attached to the inner half of the other part of the handle, the eccentric part passing into the tube, and the eccentric fitting into the dove-tailed grooved slot of the shank, substantially as described."

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14. For an *Improvement in Spring Callipers;* William W. Smith, Boston, Massachusetts, October 1.

Claim.—"What I claim as my improvement, is the circular spring, enclosed within the hollow head resting on the pivot, on which the two parts turn, and acting on the two parts, (or shanks), throwing them outward against the nut on the cross bar."

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15. For an *Improvement in Grain Driers;* Charles S. Snead, Louisville, Kentucky, October 1.

"The nature of my invention consists of a series of annular troughs, arranged one above another; the bottoms of the troughs are of concave form and double, having a steam space between the inner and outer casing; the steam spaces around the troughs are connected with each other by pipes or passages, so that steam admitted by a pipe into one steam space will pass around all the troughs in succession; a vertical drum or barrel is made to rotate within the centre of the annular troughs; this drum carries a number of scrapers fitting in the troughs.

"The meal or grain is fed into the troughs by a hopper or other convenient arrangement, and being kept in motion by the scrapers, is passed on through the heated troughs, falling through proper apertures from each trough, to the trough below it, by which the moisture is entirely evaporated from it, and it may be kept perfectly sweet for a very long time, in any climate."

Claim.—"What I claim as new, is the revolving barrel, consisting of the wheels, and the bars provided with arms carrying scrapers, in combination with the troughs, arranged one above another in the manner substantially as herein set forth, for the purpose of drying meal, grain, &c."

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16. For an *Improvement in the Construction of Endless Aprons in Threshing Machines and Grain Cleaners;* Ashley Townsend, Pavilion, Genesee county, New York, October 1.

Claim.—"What I claim as my invention, is the method of constructing the closed metallic apron, for separating grain in the manner described."

17. For an *Improved Door Spring;* Amos Westcott, Syracuse, New York, October 1.

Claim.—"What I claim as my invention, is the door spring, consisting essentially of a spring, jointed lever, strap and curved track; the latter being of the form described to control the action of the spring, and the several parts, together with the door and door-frame, being arranged with respect to each other, substantially as described."

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18. For an *Improvement in Straw Cutters;* Isaac Woodward, Mechanicsburgh, Champaign county, Ohio, October 1.

Claim.—"What I claim as my invention, is the combination of the moving cleansing bar with the stationary blade, substantially in the manner, and for the purpose set forth.

"I also claim the treadles constructed and arranged, substantially as set forth in combination with the cutter gate."

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19. For an *Improvement in Shanks of Hay Forks;* David Anthony, Sr., Spring Port, Cayuga county, New York, October 8.

"My improvement consists in making the tines, and ferrule to receive them, in a way and manner, so that either of the tines may be detached, if necessary, and another put in its place."

Claim.—"What I claim as my invention, is the constructing the hay, straw, and manure forks, with two or more tines in a separate manner, and confined in a socket, as set forth in the above specification and drawings, or otherwise substantially the same, in a way and manner, so that either of the tines can be taken out of the socket, and another put in its place, if necessary."

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20. For a *Compound for Imparting a Gloss to Clothes;* William D. Beaumont, Baltimore, Maryland, October 8; anté dated July 26, 1850.

"The nature of this composition, or compound, consists in the use of stearic acid, white wax, oil of sassafras, and spermaceti, combined in such quantities, and dissolved by gradual heat, so as to produce, when cooled, a polish, in the form of cakes or bars, to be used with the ordinary starch, in small quantities, which has the effect of imparting to the shirts, linens and other fabrics thus starched a beautiful gloss, and smooth surface, similar to that produced by the process of sizing and ironing linens in the roll, and also prevents the sad iron from adhering thereto when ironing the same, and also prevents the dust floating in the atmosphere from sticking to the linens after ironed for use."

Claim.—"What I claim as my invention, is the within described compound of stearic acid, white wax, spermaceti, and quick lime, prepared as fully set forth."

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21. For an *Improvement in Presses for Copying Letters;* George Burnham, Philadelphia, Pennsylvania, October 8.

"My press is of the paten kind, the letter from which the copy is to be taken, and the book or paper, which is to receive the impression being placed between two metallic plates, which are to be drawn together when the impression is to be taken; but I have so arranged and combined the pressing plates and the other parts of the apparatus, as to render the press much more pleasant in its action than those generally used, and much less liable to the failure of its parts."

Claim.—"What I claim therein as new, is the manner in which I have arranged and combined the two plates or platens, A and B, with the two levers E E, and with the steel spring C C, as set forth; the two plates being made to approach each other by the drawing apart of the levers E E. The two bolts D D, that are operated on by said levers, passing through the outer ends of the spring C, which is curved, and operates on the curved bottom of the plate B, in the manner and for the purpose set forth."

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22. For an *Improvement in Hay Forks;* Alinzor Clark, Southfield, Richmond county, New York, October 8.

"The nature of my invention consists in an improved mode of inserting and securing the tines in the stock or handle of the fork, by which the same fork can be used as a two-tined or a three-tined fork according to the nature of the work to be performed; two tines being better suited for some descriptions of work, and three tines for others."

Claim.—"What I claim as new in my invention, is the manner substantially as herein described of forming the tines C C, and fitting them in the stock or handles, so that they can be secured in the stock or handle, either by the wedge shank *d*, of the centre tine D, or by a detached wedge *d′* of similar form, and the pin *b;* so as to make either a two-tined, or a three-tined fork."

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23. For an *Improvement in Seed Planters;* David Eberly, Strasburgh, Lancaster county, Pennsylvania, October 8.

"The nature of my invention, is the attachment of the hoppers (with pulleys at the sides having 36 cup-holes as sowers) to the top of the shovels, and by an endless cord or rope around the pulleys and the axle of the carriage, the shovels, hoppers, &c., are drawn along, and the seeding is regulated; and having a lever bar and slider attached to the double tree, the shovels are raised simultaneously, and the feed stopped, whenever required, by the pulling of the horses."

Claim.—"What I claim is, 1st, the sliding link in combination with the lever, the catch for working the seeding apparatus by the draught of the team, as set forth.

"2d, I claim stopping the feeding by slackening the bands, and the simultaneous elevation of the shovels by the draught of the team, substantially as set forth."

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24. For an *Improved Seeding Apparatus for a Seed Planter;* Gervis S. Gardner, assignor to Gervis S. Gardner and George Rohr, Charlestown, Jefferson county, Virginia, October 8.

"The nature of my improvement consists in my using in combination with an outside or wheel frame, another frame, which I term a secondary or inside hopper frame, having a centre brace beam, or stay. This inside frame works on hinge bolts or pins, so as to be elevated or depressed at pleasure, and in order to throw seeding apparatus and drill spouts off the ground simultaneously if necessary. To this inside frame I attach a longitudinal form of hopper; and also attach thereto, the drill spouts and other apparatus.

"I also use a succession of vertically arranged ratchet-shape wheels, attached to an axle running parallel with the hopper or seeding fountain, and which wheels I designate as feeding wheels, which work or revolve vertically, and partly inside of bottom of hopper; each wheel opposite a drill spout."

Claim.—"What I claim as my invention, is the ratchet-shaped vertically revolving feeding wheels, arranged and operated in the manner, and for the purpose herein set forth."

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25. For an *Improvement in Mounting the Cutters of a Mowing Machine;* George Hart, Dillsborough, Dearborn county, Indiana, October 8.

"The object of my invention, is to construct a grass or grain cutter which shall adapt itself to the varying surface of the ground; this I do by placing a series of scythes or cutters in the perimeter of a wheel or disk which is hung at the centre by a universal joint, and is adjustable to any required height by a quadrant lever, which, actuated by an arm or treadle at the will of the operator, raises the wheel shaft vertically from the ground."

Claim.—"What I claim therein as new, is the method of constructing a revolving, grass or grain cutter, so as to adapt itself to the varying surface of the ground, by means of hanging it by a universal joint on the end of a shaft adjustable vertically, substantially as herein described."

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26. For an *Improvment in Machinery for Doubling and Twisting Yarn;* Moses Hey, Springfield, Delaware county, Pennsylvania, October 8.

"My machine is constructed either to double yarns without any more twist than is necessary to keep the strands of the double yarn together, or to give it a greater amount of twist as may be desired; it is also constructed in such manner, that when the yarn of any one spindle breaks, or runs out the machine will stop itself."

Claim.—"What I claim therein as new, is the stop wires, so constructed and connected with the head of the spindle and with the strands of the yarn, that whenever any of the latter are broken or run out, the stop wires shall move and effect the disconnexion of the machinery from the moving power, thereby stopping it, substantially as herein set forth."

27. For an *Improved Kettle for Manufacturing Comfits;* William H. Holt, Hartford, Connecticut, October 8.

Claim.—"What I claim as my invention, is the improvement in the manufacture of comfits by apparatus constructed upon the principle herein set forth, and consisting essentially of a pan moved by machinery, as herein described."

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28. For an *Improvement in Gas Meters;* T. W. Lane, Woburn, Middlesex county, Massachusetts, October 8.

Claim.—"I claim the introduction of the secondary shaft, connecting by means of a wheel and pinion with the drum shaft in the interior of the meter case.

"2d, The arrangement substantially as shown, by which the gas is passed at once into the interior of the drum, and removing the pressure from the chamber in which is the valve float, or by whatever means this effect is produced."

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29. For an *Improved Eaves Trough and Gutter Machine;* John Lee, Wellsville, Columbiana county, Ohio, October 8.

"The object of my invention, is to facilitate the manufacture of tin gutters, or eaves-troughs, by the use of a machine which bends the tin plates to the proper shape, and holds them while they are soldered together, in long lengths; and admits of quickly detaching and removing the work when finished, without the necessity of slipping it off endways. The machine also admits of turning the work for the convenience of soldering, while the tin is held firmly to the mandrel."

Claim.—"What I claim as my invention, is the grooved, movable rib, locking down to the mandrel for the purpose of holding the beaded edges of the sheets while bending and soldering,and rising to allow of inserting and removing the work, substantially as described.

"I also claim, in combination with the revolving mandrel, the piece suspended on the journals of the mandrel, and resting when required on the ledge, substantially in the manner, and for the purposes described."

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30. For a *Grain and Maize Harvester;* Edmund Quincy, Lacon, Marshall county, Illinois, October 8.

"The nature of my invention consists in a set of metallic fingers or knives (concave, flat, or fluted, and may be straight, or curved in the direction of their motion) arranged radially upon a revolving shaft, in such a manner or distance apart as to allow the straw, stems or stalks of grain to pass between them until the heads, ears, or seed, coming in contact with the fingers, are cut off by them, and thrown into the elevators, which also revolve as the shafts, and are carried by the elevators into an inclined spout, from which it falls into a wagon by the side of the machine, or other proper receptacle."

Claim.—"What I claim as my invention, is the use of the revolving shaft, in combination with a system of fingers, teeth, or knives arranged on the shaft as described, and for the purpose herein set forth, not confining myself to any particular size, shape, or curvature."

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31. For an *Improved Vulcanized India Rubber Spring;* Fowler M. Ray, City of New York, October 8.

Claim.—"What I claim as my invention, is the employment of a ring, or rings, or disks, made of any of the preparations of caoutchouc, known under the various appellations of metallic or vulcanized rubber, as a substitute for metal, or other kinds of springs, heretofore known and used, when such ring or rings, or disk or disks, or the equivalents thereof, are applied in manner substantially as herein described, in combination with a series of solid disks or plates, or their equivalents substantially as herein described, whether made of metal, or other solid or non-elastic substance.

"I also claim making the surfaces of all or either of the plates above and below, and interposed between the elastic rings or their equivalents, or the surfaces of the elastic rings, or either of them, convex, substantially in the manner and for the purpose specified."

32. For an *Improvement in Sofa Bedsteads;* Russell Scarritt, St. Louis, Missouri, October 8.

Claim.—"What I claim as my invention, is the combination of the frames, which are of the same form as the sofa-ends, with the said sofa-ends, substantially in the manner, and for the purpose as herein set forth; to wit, when the back is elevated, to convert the sofa-bed into a sofa, the frames must be swung inward against the sofa back to retain it in an elevated position, and to throw the said frames out of the way, and out of sight; and when it is desired to change the sofa-bed from a sofa to a bed, the said frames can only be swung outwards into a line with the sofa ends, so that the ledges, on the inner sides of the same, will unerringly catch and retain the back when it reaches a horizontal position as it is thrown rearwards: in which position, the sofa ends, and the swinging frames will form an ornamental and uniform head and foot to the bed-form of my improved sofa-bed."

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33. For an *Improved Gummet Strap;* Eli F. Southward, Wellfleet, Barnstable county, Massachusetts, October 8.

"The nature and operation of this strap is such that, by its use, the rope is secured to the sail by being strapped thereto by the leather in a manner altogether new, and the rope, and canvas, and ties are better protected from chafing than in any other mode now in use; a firmer foundation is thereby afforded to the grummet, rendering it more durable, and enabling the sail to bear a much greater strain without tearing away."

Claim.—"What I claim as new in this invention, is the mode of applying the above described strap, by encircling the rope therewith, and stitching or pegging the strap to the canvas, and so applying it as to insert the grummet through the strap and canvas."

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34. For an *Improved Spring Grapple;* Orra Warner and Charles S. Gaylord, Gaylord's Bridge, Litchfield county, Connecticut, October 8.

"Having thus fully described our invention, we will now proceed to state what we claim as our invention, but we would first say that we are aware that spring hooks or talons and a set joint have heretofore been employed as a trap, for which device letters patent were granted to Thos. A. Davies, in 1849; but his arrangement involves the use of a trigger to operate the joint,—our arrangement simplifies the trap in other respects, and does away with the use of a trigger."

Claim.—"What we claim, therefore, is not a set joint, but the arrangement of the tongs-shaped spring talons and set joint, constructed and acting as herein described."

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35. For an *Improvement in Cast Iron Car Wheels;* Nathan Washburn, Worcester, Massachusetts, October 8.

"My improvements consist in the manner of disposing of the metal in the wheel, so as to produce great strength and relieve the wheel from strain when cast and properly chilled, thus avoiding most of the defects to which ordinary wheels are liable when cast whole."

Claim.—"What I claim therein as my invention, is the combination of the arch at the centre with the curved plate and arms or brackets connecting the hub and rim, in the manner and for the purpose set forth."

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36. For an *Improvement in the Adjustment of Knives in Straw Cutters;* Joseph W. Webb, assignor to Benj. Gould, Aurora, Cayuga county, New York, October 8.

Claim.—"What I claim as my invention, is the mode of attaching the knives to the permanent arms, by means of the pendulous or movable arms rotating on the shaft, and secured to the permanent arms by means of screw bolts passing through elongated holes in the movable arms, thereby allowing the cutting edge of the knives to be placed at any required angle necessary for adjusting them to the bed cutter or shear, in combination with the movable box for regulating the mash of the cog of the pinion into those of the wheel, substantially as described."

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37. For an *Improvement in Portable Bedsteads and Sacking Bottoms;* Samuel Whitmarsh, Northampton, Hampshire county, Massachusetts, October 8.

"The object of my invention is to make a bed and bedstead which can be folded up in a small compass, and which, when stretched out, shall be of abundant capacity and strength, and upon which a person may lie with comfort. The bed consists simply of a piece of canvas, bound round the edges to give it the required strength, and provided with hooks or loops at proper distances apart to hang it to the posts of a frame. And this, the first part of my invention, consists in inserting gores for the swell of the body at the hips and shoulders, in a cloth to be stretched to form a bed, in whatever manner the same may be hung or stretched. In this way a bed can be made of a piece of stretched canvas which will adapt itself to the form of the body, instead of having nearly the whole weight of the body resting on the hips and shoulders.

"And the second part of my invention, which relates to the method of making portable bedsteads, consists of a series of short posts of wood, or other stiff substance, adapted with vertical grooves or fillets to receive sliding blocks, when these are combined by means of a series of connecting braces on the principle of the lazy-tongs, one set of these braces being arranged longitudinally at each side, and extending from post to post, the lower end of each brace being jointed to the lower end of the posts, and their upper ends to the sliding blocks, so that by sliding down the blocks, the posts shall be separated and braced longitudinally, and, by sliding them up, drawn together; and the posts of the two opposite sides are in turn and in like manner connected together by a series of such braces."

Claim.—"What I claim as my invention in the making of a sacking bed of canvas or other cloth, to be suspended from the edges, is the insertion of gores to fit the same to the swell of the body at the shoulders and hips, substantially as described.

"And I also claim making the frame of a portable bedstead, substantially as herein described, of a series of posts connected and combined together longitudinally and laterally by braces, on the principle of the lazy-tongs, the said braces being connected with the posts by means of joints and slides, substantially as herein described."

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38. For an *Improvement in Warm Air Registers;* Peter G. Woodside, Philadelphia, Pennsylvania, October 8.

"The nature of my improvement consists in making such an opening and closing motion to the valves of warm air registers that they may remain in any position they may be left, without the fear of closing or opening by the fluctuations of the current of warm air passing through the register."

Claim.—"I do not wish it to be understood that I claim to be the inventor of screw-racks or segments of pinions, or of the particular shape or form of the register, or of the manner in which the valves are hung, or of the ornamental front, or the head or button for turning the screw by; but what I do claim as my invention, is the manner in which I have combined the screw-racks, and segments of pinions, and the application of this combination to the purpose herein described, namely, that of opening and closing the valves of warm air registers."

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39. For an *Improvement in Looms for Weaving Figured Goods;* Avery Babbett, Auburn, Cayuga county, New York, October 8.

"The first part of my invention relates to the working of the series of shuttle-boxes. I work the entire series by means of motion communicated to it through and from a single rotating shaft, which revolves with a speed equal to one-half, or less than one-half, but never greater than one-half, of the speed with which the shaft that moves the lay revolves, the shaft that works the shuttle-boxes varying in speed according to the kind of goods required to be made.

"The next part of my invention relates to the throwing of the shuttles, and to the regulation of their throwing. I throw the shuttles by means of motion communicated to them through and from either one rotating shaft, or two rotating shafts, (and if two, parallel to each other and revolving in opposite directions with equal velocities,) revolving with a speed equal to that with which the shaft that moves the lay revolves. And I regulate the throwing of the shuttles as required by the kind of goods to be made, by causing either the one rotating shaft, or the two rotating shafts, to slide, so that the shuttles shall be driven regularly from either side as required.

"The next part of my invention relates to the positive taking up of the cloth. I take it up by means of friction rolls, which have a regular and positive motion, and around which the cloth moves, and I combine with these rolls a compensating lever, which operates so as to drive the cloth beam more slowly as the roll of cloth on it increases in diameter.

"The next part of my invention consists in a positive let-off motion, whereby I effect a regular and uniform delivery from the yarn beam, of a certain and invariably equal length of yarn at each regular and uniform delivery.

"The next part of my invention consists in preventing the opening and closing of the shed from producing an increased or diminished strain upon the warp threads. This I effect by the regular and positive advance of the let-off rolls towards the harness through an invariably equal distance at every opening of the shed, and by their return through the same distance at every closing of the shed, as hereinafter described.

"The next part of my invention relates to the working of the lay to beat up the cloth. I work it by means of slides and connecting rods or pitmans, as hereinafter described. The peculiar feature of my slide is that it is worked by means of a combination of machinery, consisting of a shaft, a crank, a crank pin, a pulley, and a slot. The motion of the slide is communicated to the lay by means of connecting rods or pitmans, which are attached to the framework of the lay, and are so arranged as to brace the framework of the lay.

"The next part of my invention relates to the throwing of the loom out of gear. I cause it to throw itself out of gear whenever a shuttle fails to go into its proper box at the proper time, and also whenever the connexion formed by any weft thread between its shuttle and the cloth is not maintained during the whole time of the passage of that shuttle through the warp threads; and this I effect by the operation of hooks attached to the bed of the lay, as hereinafter described. In the arrangement for stopping the loom, when the connexion of the weft thread is broken, the hooks are combined with wires or prongs for the reception of the weft thread, as hereinafter described, and are operated by the passage of the shuttle into the shuttle-box, as hereinafter described.

"The next part of my invention consists of a conditional let-off, whereby yarn is let off from the yarn beam in consequence of there being an improper strain on the warp thread, and whereby such letting off of yarn ceases whenever the proper strain on the warp threads is restored.

"The next part of my invention relates to the working of the draft boards, (or combs where they are used,) by forming and breaking the connexion between the draft boards, or combs, and the machinery that works them, by means of the two hooks, as hereinafter described. And, in connexion with the movement hereafter described, of the part of the jacquard machine to which the harness is attached, I use, for the purpose of moving the draft boards in correspondence with the movement of the part of the jacquard to which the harness is attached, the combination of machinery hereinafter described, consisting of the two jacks, the two rods, the slide, and the pin.

"The next part of my invention relates to the movement of the jacquard machine. I attach the harness to the knot boards, (or to their equivalent, being a part of the jacquard machine,) as hereinafter described, and I then move the part of the jacquard to which the harness is attached, regularly and statedly in correspondence with the beating up of the lay, so as to aid in opening and closing the shed, as hereinafter described. And the harness, the moving parts of the jacquard, and their connexions with the lower part of the loom, are so arranged that when the loom is to be thrown out of gear, the weight of the harness, and of these parts and connexions, opposes the greatest possible resistance to the momentum of the loom. The whole of that weight rests on the two levers, and through these levers and the two pulleys on the two cams. When the lay is back, (at which time, if at all, the loom is to be thrown out of gear,) that weight rests on the parts of the two cams that are nearest to the shaft, and therefore opposes the greatest possible resistance to the momentum of the loom. I also use, as a part of the jacquard machine, and for the purpose of permitting the draft boards to come down without crowding out the cylinder or prism, the combination of machinery hereinafter described, consisting of the two slides, the two springs, and the two needles."

Claim.—"What I claim to have invented, is, 1st, the arrangement of the machinery for throwing the shuttles, as herein described, in connexion with the arrangement of machinery for raising and lowering the shuttle-boxes; the devices thus arranged occupying the under part of the loom frame, and being more simple, compact, and convenient than other arrangements heretofore in use for the same purpose.

"2d, The winding of the cloth round the beam with uniform tension, by increasing the leverage of the tension weight, in proportion as the diameter of the roll of cloth is increased, substantially as herein described.

"3d, In combination with a positive let-off, I claim the use of a conditional let-off, constructed substantially as herein described, whereby, when there is an excess of strain on the warp threads, an increased quantity of yarn is delivered from the yarn beam; such conditional increased delivery of the yarn ceasing whenever the proper strain on the warp thread is restored.

"4th, The preventing the opening and closing of the shed from producing an increased or diminished strain upon the warp threads, by means of the regular and positive advance of the let-off rolls toward the harness, through an invariably equal distance at every opening of the shed, and by their return through the same distance at every closing of the shed, substantially as described.

"5th, The causing the loom to throw itself out of gear whenever a shuttle fails to go into its proper box at the proper time, and whenever the connexion formed by any weft thread, between its shuttle and the cloth, is not maintained during the whole time of the passage of that shuttle through the warp thread, by the operation of the hooks combined with each other, and attached to the bed of the lay, substantially as described, the hooks being, in the latter case, combined with wires or prongs for the reception of the weft threads, substantially as described, and operated by the passage of the shuttle into the shuttle-box, substantially as described.

"6th, Forming and breaking, in any required order, the connexion between the draft boards respectively, and the machinery that works them, by means substantially as are herein described; this method of working the draft boards admitting of a more simple, compact, and convenient arrangement of the machinery than others before used to attain the same end.

"7th, The combination of a rising and falling jacquard frame with the draft boards, substantially as herein set forth; whereby the depression of the frame will be simultaneous with the elevation of a part of the draft boards, and the elevation of the frame with the depression of a part; the one in this manner aiding in working and equipoising the other.

"8th, Elevating and depressing the harness and draft boards, by the simultaneous elevation or depression of all the knot boards, for the purpose of opening the sheds in looms for weaving figured fabrics, when these knot boards are arranged above the draft boards, as herein described.

"9th, In connexion with the movement of the part of the jacquard to which the harness is attached, substantially as described, I claim the arrangement of the harness, and of the jacquard, and of their connexions with the lower part of the loom, substantially as described, in such manner that, at the time when the loom is to be thrown out of gear, the weight of the harness, and of those parts and connexions, shall oppose the greatest possible resistance to the momentum of the loom.

"10th, I claim the use, as a part of the jacquard machine, of the combination of machinery hereinbefore described, as shown in fig. 4 of the accompanying drawings, such combination consisting of the two slides, the two springs, and the two needles, constructed substantially as described, and operating so as to permit the draft board to come down without crowding out the cylinder or prism, substantially as described."

MECHANICS, PHYSICS, AND CHEMISTRY.

On Resin and Water Gas. By ANDREW FIFE, M. D., *Professor of Chemistry, King's College University, Aberdeen.*[*]

Continued from page 275.

In this trial, the gas being of specific gravity 574, a foot would weigh 307 grains, and, therefore, in all 13,530 grains. The resin used was 35,000 grains, consequently the loss amounted to nearly $\frac{3}{5}$ths. There was no distillation of volatile oil, the loss must, therefore, have been occasioned by the deposit of carbon; and as the loss was as great as when the other apparatus was used, and as the gas afforded was inferior in quantity and quality, I conclude that my own apparatus was equally good with it for the decomposition of resin. The composition of resin is 10 atoms carbon, 7 hydrogen, and 1 oxygen; the compound atom weighing 75, to that of hydrogen as 1. When decomposed by heat, were each atom of hydrogen to unite with an atom of carbon, they should yield 49 of olifiant of specific gravity 976. Resin, therefore, cannot afford beyond 65 per cent.—say $\frac{2}{3}$ of its weight of heavy hydro-carbon gas, with perhaps the addition of a small quantity of carbonic oxide, and carbonic acid. But the gas afforded by the decomposition of resin, in the trials now recorded, even though it contained corbonic acid, was never of greater specific gravity than 657; there must, therefore, have been a large amount of light hydro-carbon, or a considerable quantity of uncombined hydrogen in it. It is in this way that we can account for the loss, even when there is no volatile oil distilled over. Each atom of light hydro-carbon gas that is formed, leaves an atom of carbon uncombined, because the hydrogen, in this case, takes up only half the quantity of carbon that it does when it unites with it to form olifiant gas. When any of the hydrogen escapes uncombined, then two atoms of carbon are left for each atom of hydrogen evolved; and as the weight of the carbon atom is 6 compared to that of hydrogen as 1, we observe why the loss is so great when an escape of light hydro-carbon, and especially of free hydrogen takes place. Most probably there is not much escape of free hydrogen, the gas evolved, independent of carbonic oxide and carbonic acid, consisting chiefly of olifiant and light hydro-carbon. The olifiant in the trials now mentioned amounted to 8 per cent., the carbonic acid to about 6 per cent., leaving about 86 for the light hydro-carbon, or upwards of 10 times the volume of the olifiant. Let us take a more favorable view of the case, and suppose that the light hydro-carbon is only six times the volume of the olifiant; then one atom of the hydrogen will take one of carbon to form olifiant, while the remaining six of hydrogen will take only three of carbon, thus leaving six of carbon, and allowing that the one of oxygen will unite with one of carbon, to form carbonic oxide, and which is the utmost that it can unite with, then there will remain five of the carbon in the retort. This amounts to 40 per cent. of the weight of the resin. I do not give this as what really occurs, but merely to show that there must be a great loss by the *present mode of decomposition*, and how we can account for the loss? Hence it is that we do not get so much gas as we should expect. I have said that the quantity may be considered to be from about 8 to 10 feet per pound. In the trials made by Professor Daniell the quantity did not exceed 9 feet, and the perfection of his apparatus is admitted by all.

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[*] From the London Mining Journal, No. 781.

The deposit of carbon, to which I have now referred, is a source of very great inconvenience, from its choaking up the retort, and preventing the proper decomposition of the resin. Hence the necessity of frequently cleaning out the retorts.

In the instance to which I have referred, in preparing the gas according to Mr. White's plan, it was recommended, with the view of getting the resin to be more easily melted, and, when melted, to flow more easily into the retort, that it should be mixed with refuse from the kitchen, such as waste pieces of fat and dripping, &c., all which, being, as it was said, of no value, would increase the quantity of gas, and thus lessen the price of the raw material. I presume that no one will admit the truth of this statement. Cooks generally require all the waste fat and dripping they can get; and if these be removed, something else must be supplied, perhaps at a greater price. In manufacturing the gas with Mr. White's apparatus, to which I have referred, this practice was almost always followed. I was, therefore, anxious to test the quality of the gas thus afforded, and was kindly permitted by the proprietor to do so. In the trial the resin retort only was used, and the individual in the custom of manufacturing the gas had charge of the heating, &c.; 2¾ lbs. of resin and 2¾ lbs. of tallow were employed. After being cautiously melted and thoroughly mixed, the liquid was decomposed in the usual way, and afforded 43 ft. of gas of specific gravity 716—that is, 7·8 ft. per lb. It contained 8 per cent. of carbonic acid. The condensation by chlorine amounted to 13·25. The durability with the jet and 5-inch flame was 54′—that is, 1·1 foot per hour. With the jet the light was that of 1·4 candles per foot. Giving it the advantage of the argand, the light would, perhaps, have been about that of 2·5 candles per foot. This gas, the specific gravity of which was 716, weighed, therefore, in all 16·500 grs. The resin and tallow together weighed 38,500 grs. The loss was, therefore, nearly one-half of the materials employed in its manufacture.

Similar trials were made with oil alone, with my own apparatus, the retort having been brought to the usual degree of heat: 6½ lbs. of oil yielded 51 cubic feet of gas of specific gravity 806—that is, 7·8 ft. per lb.; with the jet, the durability was 68′ 20″—that is, 0·87 of a foot per hour. It contained 6 per cent. of carbonic acid. By the jet the illuminating power was 3·75 candles per foot; by the argand, 5·6 candles per foot. The gas being of specific gravity 806, and 51 ft. from 6½ lbs., the loss was upwards of one-half of the material employed in its manufacture.

It is generally allowed that, by cautiously conducted trials, a gallon of oil will yield about 100 ft. of gas; but this is seldom obtained in practice, unless when the gas is of inferior quality; for, it is well known that, by a particular mode of decomposition, a large quantity of poor gas may be procured. I have seen oil gas of specific gravity 940. That referred to by Dr. Henry, in his trials with it, was 906. In numerous trials which I made, many years ago, at the oil gas works at Leith, and also with a small apparatus erected for lighting a manufactory in Edinburgh, I did not find the specific gravity to be beyond 710. In some instances it was only 645. The gas of specific gravity 710, was at the time considered to be of good quality. The condensation by chlorine amounted to 32 per cent. The quantity of gas obtained from a given weight of oil was not ascertained, but let us suppose that it came up to the full allowance—that is 100 feet from a gallon, then the loss amounted to nearly one-half. Taking the gas of specific gravity 906, there must have been a loss of about one-third, supposing that 100 ft. were procured from the gallon; but of this I have my doubts. I am inclined to think that in *practice*, there is in the conversion of oil to gas, a loss of about one-half; and that, therefore, in the trials which I have recorded, the loss was not greater than that which usually occurs. If it be thus with oil, I suspect it will be found to be at least to that extent with resin. In Mr. White's statement 10,000 feet of gas are got from 6 cwts. of resin, with an additional quantity of water. It is understood that Mr. White's gas contains about equal volumes of resin gas and of water gas, very frequently more of the latter; therefore, from the 672 lbs. of resin, about 5000 feet of gas are got—that is, 7·4 feet from the pound. The gas is said to be of the specific gravity 924, if so, the loss is nearly one-half. If we take the appended statement—viz., that the quantity of resin used was upwards of 7 cwts., then the loss must have been much greater.

I come now to consider the quality of the water resin gas, or, as it is very improperly called, the hydro-carbon gas, and its value for the purposes of illumination. This gas is generated by the decomposition of water and of resin in separate retorts; the former being decomposed by heat, the latter by heat with the aid of carbon and of iron. If what I have already said be correct, it is evident that the gas thus produced is merely a mixture of resin gas—that is of a gas resembling coal gas in its composition—and of hydrogen, with variable proportions of carbonic oxide and carbonic acid, according as the water is decomposed. I regret that I cannot give the results of the manufacture of the gas by the apparatus erected under the superintendence of Mr. White, as I fully expected to have been able to do. In the different attempts which I made to ascertain the quality of the gas manufactured by that apparatus, several circumstances occurred to prevent me from arriving at the truth. In the first trial I found the gas of high illuminating power, but it was afterwards ascertained that tallow was mixed with the resin; in what proportion I did not hear. At my next visit the gas was made by using both retorts, employing resin for the one, and water for the other; but it was afterwards discovered that the water retort was not in action, consequently, the gas collected was entirely that from the decomposed resin, or a mixture of resin and tallow. I was obliged, therefore, at that time, to give up the attempt, not from any unwillingness on the part of the proprietor, for he was extremely anxious to ascertain the truth, but from the difficulty of getting the apparatus into proper working condition, though it had been erected for a very short time. This put a stop to future proceedings. I do not, however, consider this of great consequence. I have ascertained the quality of resin gas, of gas from mixture of resin and tallow, and of water gas, *separately*, and as these, by Mr. White's process, are generated in separate retorts, we must consider the gas thrown into the gasometer to be merely a *mixture* of those mentioned, in variable proportions, according to the proportions of the articles employed in their manufacture, and the rapidity with which the one and other is decomposed. We can thus arrive at the quality of the hydro-carbon gas, as it is called, and its consequent expense for the purposes of illumination, as compared with other sources of light, as, for instance, with coal gas.

I have already said, that as resin is composed of C 10, H 7, O 1, the utmost that it can yield of olifiant is 49; of light hydro-carbon, about 28 from 75 of resin—that is, about 64 per cent. of the former, and about 37 per cent. of the latter. But resin never yields olifiant only: independent of carbonic acid and oxide, the gas is a mixture of olifiant and light hydro-carbon, with perhaps a slight admixture of uncombined hydrogen. I have shown that the gas, when it contains about 6 per cent. of carbonic acid, varies in specific gravity from about 570 to 660. I have never found the condensation by chlorine to exceed 8 per cent., thus making the composition to correspond with the specific gravity; for a gas composed of 8 of olifiant and 92 of light hydro-carbon would be of specific gravity a little above 600. I have no doubt that resin gas, when free from carbonic acid, will be found to be of about that specific gravity. I stated the specific gravity of the water-gas, as generated by Mr. White's process, to be about 574. Supposing that it is mixed with an equal volume of resin gas, then the specific gravity ought to be about 580, or somewhere between that and 600—that is, presuming the absence of carbonic acid. Supposing the per centage of carbonic acid to be about 6, then the specific gravity would be about 630.

I must confess that I am at loss how to reconcile this with the very remarkable statement made by Mr. White in the *Gas Journal* for April last. It is there said that the gas manufactured from *resin and water* is of specific gravity 924, and contains 12½ per cent. of olifiant. A gas having 12½ per cent. of olifiant, the remainder being water gas, or light hydro-carbon, would not exceed 650 in specific gravity. His gas, therefore, must either have contained much more olifiant, indeed have been composed almost entirely of olifiant, or must have had a very large admixture of carbonic acid or carbonic oxide. Resin gas, I have said, did not in my trials contain beyond 8 per cent. of olifiant. The high specific gravity of his gas must, therefore, have been occasioned by carbonic acid or carbonic oxide, perhaps by both, the latter of which is valueless for the purpose of illumination, and the former detrimental.

With regard to the illuminating power. I have never been able to manufacture gas from *resin alone* with more than 8 per cent. of olifiant. Mr. White states that, by his improved process, he gets the gas from *resin and water* with 12½ per cent. of olifiant. How is it possible that, by the addition of resin gas to another gas of lower specific gravity and illuminating power he gets a gas of higher illuminating power and greater gravity? To me it is a puzzle. I wish much that he had entered more minutely into a description of his improved process, and had also stated his method of ascertaining the specific gravity, the illuminating power, and the per centage of olifiant.

That there is a large admixture of carbonic acid in Mr. White's gas, when he takes the specific gravity, appears certain from what he has stated in the paper referred to. He says that now there is but little carbonaceous deposit in the retort, owing to the peculiar mode of arrangement and admission of the hydrogen and carbonic oxide. Now, as by the manner of decomposing the water, oxide of iron is formed in the retort, it is evident that the whole of the oxygen of the water is not converted to carbonic oxide by its union with carbon; the specific gravity of the gas, therefore, which is evolved from the water ought to be below 522, which is that of a mixture of equal volumes of carbonic oxide and hydrogen; but suppose that it is not much below that, and that no carbonic acid is present, then to get from resin and water a gas of specific gravity 924, containing olifiant, with the residue composed of equal volumes of hydrogen and carbonic oxide, which it should be were all the oxygen disengaged as carbonic oxide, there ought to be about 87 per cent. of olifiant. Supposing that Mr. White's gas was a mixture of olifiant, carbonic acid, and water gas, which contains equal volumes of carbonic oxide and hydrogen, and that the water gas is about 522 specific gravity, and that the olifiant was 12½ per cent., then, to have it of the specific gravity 924, it should be about 12·5 olifiant, 52 water gas, and 35 carbonic acid. Were the carbonic acid removed from this gas, the specific gravity would be a little above 600, most probably the real specific gravity of the *inflammable* gas obtained from resin and water together. With regard to the illuminating power of the water resin gas, Mr. White has stated that "it is 26·5 per cent. superior to Manchester Cannel gas, and 20·5 per cent. to the Salford Cannel gas." In my paper published in No. 1 of the *Gas Journal*, I have shown that these Cannel coal gases are nearly of the same quality, and contain 7.6 per cent. of olifiant. By the chlorine test, independent of durability, the illuminating power of Mr. White's gas, containing 12·5 of olifiant, ought to be 64 per cent., instead of 26·5 and 20·5, beyond that of the coal gases he mentions. Of course, if we take durability also into the account, the value should be greatly beyond that. The specific gravity of the Manchester gas at the time I tried it was 451. I have formerly shown that the durabilities, with the same burner, are as the square roots of the specific gravities. Taking durability into account also, the illuminating power of Mr. White's gas ought to be at least 90 per cent. greater than that of the Manchester gas.

It is evident from this, either that Mr. White's gas must be one *sui generis*, or that there is some strange inaccuracy in the mode of ascertaining the quantity, and of testing its qualities. Can it be that the quantity of gas evolved, say 10,000 feet, of specific gravity 924, from 6 cwts. of resin and 24 gallons of water, and which I have said is a mixture of olifiant, light hydro-carbon, carbonic acid, and carbonic oxide, with perhaps a little hydrogen, was the quantity indicated by the meter, immediately after the gas escaped from the retort, and was then of the specific gravity stated, and that, after it had stood over water in the gasholder for some time, and by which it would lose its carbonic acid, it then contained 12·5 of olifiant. If so, the quantity of gas valuable for the purpose of illumination must, by the abstraction of carbonic acid, be far below what Mr. White states. Be that as it may, till Mr. White describes more minutely than he has done his method for finding the quantity and quality of the gas, I must adhere to the conclusions which the trials I have now recorded warrant—viz., that the quantity and quality of gas, after being properly purified, will be found to be far inferior to what Mr. White has stated; that in all probability the quantity of gas from *resin* will in practice not exceed 8 or 9 ft. per lb.—that is, about 1000 ft. per cwt.; that the gas after being purified will be of specific gravity not much beyond 600; the condensation by chlorine not beyond 8 or 9 per cent.; a foot of it not giving more than the light of from 2½ to 3 candles. If so, then, when that gas is mixed with about its own volume of water gas, no doubt the quantity will be increased, but to the *serious deterioration of the illuminating power*. That of the water may be said to be *nil*, or a very near approach to it; consequently the reduction in the illuminating power of the other will be just in proportion to the addition; indeed, were it not that the water gas adds to the quantity, and perhaps, from the peculiar mode of generating it, also adds to the specific gravity, of which as an indication of the value, some have a high opinion, I strongly suspect that Mr. White had better dispense with it altogether, and thus save the trouble and expense of manufacturing, and of storing and transmitting to the public, an article which, for the purpose of illumination is, as now generated, absolutely useless.

After what has been said, I scarcely think it necessary to advance anything with regard to the expense of manufacture, and the supposed economy of water resin gas, as a source of light. If I am correct in my assertion that 1 cwt. of resin will yield 1000 feet of gas, of illuminating power equal to that of the best English caking coal gas, or of the Lancashire and Yorkshire Cannel coal gas, while the cost of the raw material for the manufacture of the former is at present 3s., and for that of the latter at Manchester is about half that sum, then there must be an enormous saving by the sale of the products of distillation to make up for the difference. While much saving must result from shortening the time, yet, to drive off the same quantity of gas, it will be found that very nearly the same amount of heat will be required, and, consequently, nearly the same consumption of fuel will be necessary. With regard to the saving from the products of distillation, I am not prepared to speak; but this is not necessary, enough has been already said, to prove the absurdity as to the value put upon them by Mr. White.

Since writing the foregoing, some papers have unexpectedly been sent to me, regarding hydro-carbon gas, containing statements, on one of which in particular I feel called on to make some remarks. Referring to the hydro-carbon gas, as *made in the neighbourhood of Aberdeen*, it is said to be "of specific gravity 936, and shows an illuminating power superior, as compared with the Aberdeen gas, of 33·1 per cent. With the chlorine test, it shows an illuminating power of 28, while the Aberdeen gas shows only 14, and its durability, burning at 7-10ths of an inch pressure, is 82·30 to 61·40 Aberdeen gas." This paragraph appeared in an Aberdeen newspaper a twelvemonth ago, and now forms part of a manifesto issued by Mr. White, dated May, 1850. The gas there alluded to was that experimented on by me, when I first visited the water resin gas apparatus erected by Mr. White. The results stated are certainly correct, in so far as they are the results obtained by me, *with the gas on which I then experimented*. I did not take any notice of this paragraph at the time, not being in the custom of replying to newspaper observations. I cannot now, however, allow it to pass unnoticed, especially as it forms a part of the "puff direct," by Mr. White, and also, as it is well known here, that the experiments were made by me. Were no allusion made to it, it may appear that I have sanctioned this statement of the very high value of the hydro-carbon gas, as proved by my experiments. With regard to the trial referred to, I have already said that I had got permission to try the quality of the water resin gas, manufactured by Mr. White's apparatus. I had expected that I should witness its preparation; but on my arrival, I found that this could not be accomplished, and was therefore obliged to *test gas previously manufactured.* I was certainly surprised at the very high specific gravity and illuminating power, and said so at the time, and expressed my desire to have another trial. It was not till afterwards that I was informed that instead of *resin only*, a *mixture of resin and tallow* was employed; in what proportions was not stated. Still, making allowance for this, I was not satisfied that these, with the addition of water gas, should afford a gas of such high illuminating power, and I again requested to be permitted to test the quality of the gas, on condition that I should be allowed to witness the whole proceedings. This was obligingly granted. At my next visit, the retorts being heated, and being aware that it would make no difference in the quality of the gas whether the resin gas and water gas were prepared at the same time, or were manufactured the one after the other, I suggested the propriety of adopting the latter method, that I might have the opportunity of ascertaining the proportions of the gases from the different materials, more especially as I had my suspicions that the supply of water gas was deficient. The resin gas was accordingly first made. We then proceeded to the manufacture of the water gas, but *not a particle came off*. Everything was done that could be devised, but without success; we were, therefore, obliged to desist. On drawing the fire, to enable us to examine the retort, we found that it was cracked, and, consequently, the gaseous matter, if any was formed, had escaped into the fire. The gas collected in the gasholder was, therefore, not water resin gas, but that from *resin alone*.

With regard to the gas referred to in the paragraph quoted, and which is stated to be hydro-carbon gas (that is water and resin gas), I maintain that *it did not contain a particle of water gas*. It was not even resin gas; it was procured from a mixture of resin and fat;—the *latter*, I have no hesitation in saying, in *by far the largest proportion*. Strange that that gas, said to be water resin gas, should be of specific gravity 936, contain 28 of olifiant, and have durability 82′ 40″; while gas which I saw prepared by the same apparatus, from a mixture of equal parts of resin and fat, should be only of specific gravity 716, have 13·5 of olifiant, and durability only of 54′. Does not this show that I am correct in saying, that the gas thus blazoned forth as water resin gas was prepared from fat and resin only, *the former in very large proportion*.*

There is only one other circumstance to which I would advert, also stated in the papers referred to. It is often said that the most important part of a letter is contained in a postscript, and in one of the printed papers issued by Mr. White there is a P.S. which is certainly very important, because it is contradictory of a previous statement, and seems to let out the secret regarding the enormous quantity of gas obtained. He there states, "One cwt. of resin yields by my system, if *wrought up*, 2000 feet of gas or more, possessing an illuminating power 26½ per cent. superior to Manchester gas. I find it, however, more economical not to convert the whole of the resinous matter into gas;" "it may be found more profitable not to push the quantity of gas beyond 2000 feet from each cwt. of resin, although at the works erected by me at Bristol they regularly obtain 3500 to 4000 feet from the same quantity, *by fully working up the residuum*." In a P.S. it is said, "Some may not understand why I only obtain 2000 feet from each cwt. of resin, while at Bristol 3500 to 4000 feet is produced from the same quantity. This is easily explained. The gas at Southport is 26½ per cent. superior to that of Manchester; by, therefore, merely *adding that additional per centage of my water gas* (and they add still more at Bristol) you have about 3500 feet, equal still to Manchester gas." Here, then, the greater quantity of gas is accounted for, at one time by *working up the residuum*, at another by the *additional per centage of water gas.* Hence, from 1 cwt. of resin any quantity of gas may be got, provided an additional supply of water gas be introduced. But, then, as Mr. White properly admits, this acts injuriously on the illuminating power, consequently the less that there is of the water gas the better, in so far as light-giving is concerned. Here again, we have additional proof of what I have already advanced, derived from Mr. White's own statement. He has said that in his process the water costs *nil.* I go still farther, and maintain that the water is *nil*, not only before it goes into the retort, but also (if this word will admit of a comparative degree) that it is worse than *nil* after it escapes from it. Why, then, use it? Merely, I presume, because it *adds to the quantity*, and with some, quantity goes a great way.

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* I beg distinctly to be understood, in making this remark, that I am not throwing out any reflections against Mr. White, far less against the proprietor of the apparatus, to whom I am indebted for his kind permission to test the quality of the gas. The latter was not aware of the state in which the apparatus was at the time; the former, so far as I know, knew nothing of the proceedings.

On the Preparation of Green and Grey Colors from Oxide of Chromium, for Calico Printing. By Dr. W. H. De Kurrer, *of Prague.*[*]

Greens, prepared from oxide of chromium, for cylinder printing, were first introduced into Bohemia in 1840, and soon became universally employed in printing establishments; and immediately upon their adoption came also into use the numerous tints of pearly-grey, likewise obtainable from oxide of chromium. Colors prepared from oxide of chromium possess the valuable property of resisting the action both of light and air, acids and alkalies, and may consequently be classed amongst the fast colors. In preparing these colors for printing cotton fabrics, the substances employed are principally chloride and nitrate of protoxide of chromium, and chromo-sulphate of potash or chrome alum. The chloride of chromium, called also sea-green in the Bohemian manufactories, is employed in the following manner in calico printing establishments, for the purpose of producing the green oxide of chromium. At the commencement of the process, the green hydrate of oxide of chromium is prepared by first dissolving 4 kilogrammes[†] of bichromate of potash in 22 litres[‡] of boiling water. Then, into a boiler or vessel containing 108 litres of boiling water, 4·5 kilogrammes of pulverised white arsenic are thrown, and boiled for ten minutes; a precipitate will be formed, and must be allowed to settle; the clear liquor is then run off, and immediately mixed with the solution of bichromate of potash, stirring all the time; in a short time the mixture acquires a green tint, and the hydrated oxide of chromium will be formed and precipitated. After being several times well stirred, and allowed to cool, the whole is thrown upon a filter of white wool, and the hydrate of chromium remaining on the filter is carefully washed with boiling water. It is then dried, and is ready to be employed for the preparation of the chloride. In order to obtain the latter salt, hydrochloric acid of 22° Beaumé is diluted with water, until the acid no longer gives off vapor. It is then heated, and whilst hot, as much of the hydrated oxide of chromium prepared as above is added, as will saturate the acid and leave a slight excess of the oxide undissolved. The whole is then left to settle, and the clear liquor is decanted from the undissolved matter. In this state the solution of chloride of chromium still presents some traces of free acid, which would act injuriously upon the fibres of the cotton. To remove this, and obtain the product in a neutral state, potash ley (marking 20° Beaumé) is poured in very gradually until the oxide of chromium begins to be precipitated. The solution of chloride of chromium thus prepared, and which is of a dark green color, is evaporated until it marks 46° Beaumé. After cooling, a coloring matter is obtained from it, consisting of oxide of chrome of the finest green color. This preparation is sold under the name of sea-green. Before this substance (which can be used with greater advantage than any other preparation for printing in green upon calico) was known, the following, amongst other preparations, were employed for obtaining chrome green:—

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[*] From the London Journal of Arts and Sciences for August, 1850.

[†] About 2 lbs. English. [‡] About a quart English.

1*st Preparation.*—To a solution of 0·656 kilogrammes of bichromate of potash in 3 litres of water, add 1·406 kilogr. of hydrochloric acid, and afterwards 0·250 kilogr. of pulverized tartaric acid. By the addition of the tartaric acid the solution acquires a fine green tint, together with a sweet taste. The following proportions have been given for producing the various shades of color required:—

	kil.	kil.	kil.	kil.	kil.	kil.
Chromate of potash...	1·750	2·875	1·000	0·500	0·437	0·375
Hydrochloric acid.......	3·125	1·625	1·750	1·000	0·937	0·750
Tartaric acid...............	2·500	1·625	0·500	0·250	0·172	0·187

All these compounds (which have a slightly acid reaction) are, when used for printing, thickened with starch or wheat flour, gum tragacanth, or other gums; and, to fix the colors, the printed fabrics are, according to the tint required, kept stretched in the air for several days, and then washed; or they are passed through a bath of chalk, or of ammonia. This bath of ammonia is prepared with 24 litres of boiling water, 4 kilogr. of slacked lime, and 2 kilogr. of hydrochlorate or sulphate of ammonia, and the fabrics are submitted thereto by being passed several times through a machine similar to that used for printing ground colors; a free current of air being kept up to carry off the pungent odour of the ammonia.

2*d Preparation.*—0·500 kilogr. of bichromate of potash are boiled in 3 kilogr. of hydrochloric acid until chlorine ceases to be evolved; 0·500 kilogr. of soda, previously calcined, and 0·500 kilogr. of caustic soda ley, marking 14° Beaumé, are then added; and for printing, the liquor is thickened with gum tragacanth. The piece, when printed and dried, is passed through a boiling ammoniacal bath, composed of 0·500 kilogr. of caustic lime, 0·500 kilogr. of hydrochlorate or sulphate of ammonia, and 24 litres of water; after which, it is well washed, and finally stretched and dried.

3*d Preparation.*—To a hot solution of 0·656 kilogr. of bichromate of potash in 3 litres of water, 0·500 kilogr. of syrup are added, and afterwards, by degrees, 2 kilogr. of hydrochloric acid, marking 34° Beaumé, which causes this liquor very shortly to assume a green tint. It is neutralized with caustic soda, the color is thickened as in the first preparation, and the printed fabric is finished in the same manner.

4th Preparation.—Nitrate of chromium is prepared by dissolving in nitric acid the green precipitate of oxide obtained by arsenic in the same manner as the chloride is prepared with hydrochloric acid. This green, thus obtained, gives a yellowish tint upon cotton fabrics.

Printing sea-green with the roller.—For cylinder printing with chloride of chromium, the color must be thickened either with gum tragacanth or starch. The following is the mode of proceeding:—

1. *Thickening with gum tragacanth.*—Take 0·220 kilogr. of gum tragacanth reduced to very fine powder, which make into a thin paste with alcohol; then cover up the vessel in which this operation is carried on, and leave it to settle for a few hours; after which, add 14·250 litres of solution of chloride of chromium, marking 46° Beaumé; leave the whole for from 24 to 36 hours, merely stirring occasionally, and finally strain it through a cloth. When the color is too thick for printing delicate designs from the cylinder, it is only necessary to add more of the solution of chloride of chromium until the desired consistence is attained.

2. *Thickening with starch.*—Mix intimately 2 kilogr. of starch with 5 litres of water; boil the mixture to the consistence of glue; let it cool, and add the solution of chloride of chromium, marking 46° Beaumé, until it is of the consistence required for printing.

As gum tragacanth is of a denser nature than starch, it furnishes bolder and more intense colors than the latter. After printing, the fabrics are stretched on a frame, and left during the night in a cool place; the next day they are treated with caustic potash ley, marking 2° Beaumé, well aired, pressed as dry as possible, and then laid for about an hour in running water, washed with washing wheels, pressed and dried, and finally submitted to the process for brightening the colors.

After fixing the yellow, green, and blue colors, by passing them through lime or by immersion in the bath of acid chromate of potash, the operation is completed; the brightest possible green is obtained by passing the fabric through a bath of acetate of copper, as a portion of the green chromate of copper then combines with the chrome green, and heightens its tone. The operation is conducted as follows:—The proper quantity of water is heated, in a suitable vessel, to a temperature of 55° or 56° Cent., 2 litres of a solution of acetate of copper are added, and the printed pieces are passed twice backwards and forwards through the liquor; they are then placed in running water; after which, the moisture is pressed out of them, and they are dried. When six pieces have been passed through the copper bath in the manner described, 2·375 kilogr. of solution of copper are added for each successive piece, and this is continued so long as there are any pieces to operate upon. The salt of copper gives to the green color a peculiar lustre, without having an injurious influence over the other colors present,—even the chrome-yellow loses none of its beauty. The acetate of copper is prepared by dissolving 20 kilogr. of sulphate of copper or blue vitriol in 72 litres of water, decomposing by 10 kilogr. of sugar of lead, and using the clear supernatant liquor.

Printing with two green colors.—When, by means of a reserve of arseniate of potash, figures dyed red or violet by madder are stopped out, and the white parts of the fabric printed by hand from a design in relief, with a solution of chloride of chromium thickened with starch or gum tragacanth, then, by afterwards printing over this with sea-green, by means of the cylinder, a dark green pattern will be obtained upon a light grey ground; and after applying the other colors requisite for completing the design, the fabric is passed through a bath of acetate of copper to brighten the greens.

Cylinder printing with yellow designs upon a green ground.—Yellow patterns upon a green ground may be produced by printing (after applying the reserve to protect the madder reds and purples) with the base of lead, and afterwards applying the chrome green with the printing roller. Fabrics thus treated are passed through milk of lime at a temperature of 38° Cent.: they are washed and dried, and then the fast blue, green, and yellow colors are printed; the fabrics are again passed through milk of lime, and after being well washed, the yellow and green colors are brought out by a bath of acid chromate of potash.

The preparation of lead for this purpose consists of the following composition:—3 kilogr. of pipe-clay are damped with 1·780 litres of water, and mixed with 3·560 kilogr. of gum water, to which is added 1·440 kilogr. of a solution of chloride of zinc. For every litre of this solution 0·150 kilogr. of acetate of lead, dissolved in a small quantity of water, is added before printing.

Chrome olive.—Very fine and fast olive colors may be obtained suitable for cylinder printing (upon which yellow patterns may be produced by acetate of lead) by means of the following preparations:—

1. *Light olive.*—To 12 litres of solution of chloride of chromium thickened with starch add 2 litres of cachou-brown.

2. *Medium olive.*—To 12 litres of solution of chloride of chromium thickened with starch add 2·350 litres of cachou-brown.

3. *Dark olive.*—To 12 litres of solution of chloride of chromium thickened with starch add 3·560 litres of cachou-brown.

The cachou-brown, which is added to the oxide of chromium or sea-green to form olive colors, is prepared by dissolving 2·5 kilogr. of Gambia cachou in 10 litres of water over a gentle fire, and straining the decoction through a fine sieve; 2·375 litres of this solution are then boiled with 0·155 kilogr. of starch, 0·090 kilogr. of verdigris, and 0·120 kilogr. of sal-ammoniac.

The day after printing, the olive colors may be brought to any desired shade by the following means:—

1. To produce a brown tint, the pieces are introduced into a vat furnished with a drum, and containing milk of lime, (at a temperature of 40° Cent.,) and afterwards carefully washed. 2. In order to approach nearer to an olive green, instead of milk of lime, they are passed four or five times over the drum (a single piece at a time, and in one direction only) through a bath of acid chromate of potash. 3. When it is desired to bring the above colors to a more decided green, the pieces, after having received all the colors required, viz., the yellow, the fast blue and green, and also the sea-green, are passed through a bath of acetate of copper, heated to 60° Cent.

Cylinder printing in green by means of arseniated chloride of chromium.—Shades of green may be obtained, differing somewhat from the ordinary sea-green, by the employment of arseniated chloride of chromium, prepared in the following manner:—In a large earthen vessel a mixture of 4 kilogr. of hydrochloric acid and 9 litres of water, are heated to ebullition on a sand bath; to the liquor is added 3 kilogr. of bichromate of potash. When the solution is complete, 3·650 kilogr. of finely-pulverized white arsenic are introduced in small quantities, in order that the liquor may not rise and overflow. When the arsenic is likewise completely dissolved, the solution is allowed to cool; the clear liquor, when decanted, is kept ready for use.

For immediate use 1 kilogr. of starch, and 0·060 kilogr. of finely-powdered gum tragacanth are boiled in 8 litres of water, and the mixture is allowed to cool. Into 8 litres of this thickening mixture 32 kilogr. of arseniated chloride of chromium are slowly poured, and when properly mixed, 6·5 kilogr. of potash ley of 16° Beaumé are added very gradually, stirring briskly all the time. The color appears very thin before the addition of the potash; but it is thereby thickened and rendered suitable for cylinder printing. The fabrics printed with this preparation are the next day passed through a weak potash ley, (heated to 60° Cent.,) to which a small quantity of milk of lime has been added; they are then well washed, stretched, and dried.

To produce a fast green color, approaching to grey, take 12 litres of green printing color, and 2·375 litres of fast blue, prepared from indigo, mix them together, print the fabrics therewith, and next day pass them through milk of lime; wash with clean water, and stretch and dry them as before.

In order to *impregnate* the fabric with the color by means of the cylinder machine, so as to produce a uniform green ground, mix gradually 71 litres of the solution of arseniated chloride of chromium, marking 55° Beaumé, with 6·500 kilogr. of solution of potash, of 16° Beaumé, diluted with about 15 litres of water; then add 3 kilogr. of mucilage of gum tragacanth, and 0·040 kilogr. of chloride of iron, and 0·067 kilogr. decoction of logwood, of 2° Beaumé.

Pearl-grey color for printing.—This pleasing color is obtained by means of sulphate of chromium, and of potash (chrome alum). It is prepared in the following manner:—Into four large stone vessels are severally poured 2 kilogr. syrup of sugar, and 2 kilogr. of thick gum-water, prepared by dissolving 1·50 kilogr. of gum in 1·25 litres of water. Into each vessel a hot solution of 2 kilogr. of bichromate of potash in 6 litres of water is then poured, the mixture being briskly stirred. After being allowed to cool down to 30° Cent., 2·50 kilogr. of colorless sulphuric acid diluted with water (say 2 kilogr. acid, and 3 litres water) are added, again stirring briskly. After the lapse of a short time, the liquor will become spontaneously heated, and rise rapidly. In order that no loss may arise, the liquor which may overflow should be received in another vessel. The color gradually changes from orange to olive-green, and finally to dark grey. It must be stirred from time to time until the liquor ceases to froth up, when it will be found to have acquired a fluid consistency, and a blackish-grey color. As soon as the rising ceases, that which had overflowed is poured back again, and, when perfectly quiescent and cold, the contents of the four pots are mixed together, when the liquor will be ready for use, it being found to consist of a compound or mixture of sulphate of chromium, with sulphate of chromium and potash (chrome alum).

This color will be found well adapted for cylinder printing, which is performed in the ordinary manner of printing with starch colors, viz., by introducing a cylinder provided with a woollen band into the dye-vat, from which the color is fed to the engraved cylinder. Ten pieces of calico may be easily printed off with this color without changing the doctors, as they are not affected by it.

The next day after printing, the fabrics are stretched upon frames, and immersed during six minutes in a vat filled with milk of lime; they are then left for an hour in running water, and passed through a bath of hot water to dissolve all the reserve, in order that this may be completely washed out in the washing machine; and they are afterwards dried.

Green patterns upon a pearl-grey ground.—These may be obtained perfectly fixed by preserving the madder reds and violets with the reserve of arseniuret of potassium, then printing on the white ground the patterns in sea-green, and afterwards with the cylinder applying the pearl-grey color.

Yellow patterns on a pearl-grey ground.—These are produced with the preparation of lead, in the same manner as above described for sea-green.

Yellow, green, blue, and cachou-brown colors may be advantageously applied to the above; and in passing through a bath of milk of lime and another of yellow and neutral chromate of potash, the yellow and green will be brought out, and the cachou-brown fixed.

The bath of neutral chromate of potash, for bringing out and fixing the colors, is prepared in the following manner:—Into a vat, provided with a drum, and three parts filled with water, a solution of 3 kilogr. of neutral chromate of potash is poured, to which are added not more than from 4·750 litres to 5 litres of vinegar, in order that it may not be acid, as bichromate or acid chromate of potash would convert the pearl-grey into chromate of chromium, which is of a brownish yellow color. The yellow, to be good, should appear in the bath of neutral chromate of potash of a brimstone color,—the green having always, on the contrary, a pear-green tinge; consequently, in printing in pearl-grey, should a fine grass-green be required, a good steam color must be resorted to.

Pearl-grey, approaching to blue.—To produce this color, the sulphate of chromium and potash must be prepared as follows:—In 6 litres of water 4 kilogr. of bichromate of potash, in small pieces, are dissolved; 2·5 kilogr. of colorless sulphuric acid are diluted with 2 litres of water, and this dilute acid, when cold, is poured slowly into the solution of chromate, which is stirred; then add 2 kilogr. of powdered sugar, in small portions at a time,—which addition will cause an elevation of temperature and great effervescence. When the mixture is cold, the sulphate of chromium and potash possesses a certain degree of consistence, and, for printing, the following proportions of syrup and British gum are added as thickening matter:—1st. 2·375 litres of syrup are diluted with 2·375 litres of water, and added to 4·750 litres of solution of chrome alum. 2d. 3 kilogr. of British gum are boiled in 3 litres of water, and after complete cooling, are poured into 4·750 litres of the solution of chrome alum. Neither dry gums nor gum water will serve as thickeners for this color, as gums contract and form with the double sulphate of chromium and potash a hard matter resembling leather. The printed fabrics are next day passed through milk of lime, and treated in the manner above mentioned. If to 12 litres of the pearl-grey about 1 litre of the cachou color, prepared in the same manner as for chrome olive, be added, a peculiar reddish-grey color will be produced.

Chrome-green printing color.—A very fine green color (suitable for printing stripes upon cotton) may be produced by preparing chloride of chromium in the following manner: 4 kilogr. of pulverized white arsenic are dissolved in 106 litres of water by the application of heat; 3·5 kilogr. of bichromate of potash are also dissolved by heat in 14 litres of water, and this solution is poured slowly (stirring continually) into the arsenious solution. After cooling, the green precipitate is thrown upon a cloth, and when well drained, 5 kilogr. of hydrochloric acid of 22° Beaumé are added to it; it is then dissolved in a sand bath and evaporated to 4° Beaumé, neutralized by means of 1·750 litres of soda ley at 20° Beaumé, stirring continually; and, finally, the liquor is thickened with 100 grammes of gum tragacanth, finely powdered;—when it will be fit for printing. The fabrics thus printed are left for 24 hours in a cool place, and then dried.

Steel green-grey steam color.—To prepare this color, which is chiefly employed for printing cotton stripes, the chrome alum is prepared as follows:—Into a solution of 7·5 kilogr. of bichromate of potash in 15 litres of water, pour slowly 4·625 kilogr. of colorless sulphuric acid, and mix gradually with the liquor 1·875 kilogr. of raw sugar. The stone vessel in which this solution is effected is kept hot in a sand bath, until the mixture has acquired an emerald-green color, when it may be left to cool.

Color for printing.—To 2·375 litres of starch paste, prepared with 0·360 kilogr. of that substance, are successively added 7·125 kilogr. of chrome alum, 9·5 kilogr. of cachou-grey, and 0·900 kilogr. of acetic acid of 3° Beaumé.

To prepare the cachou-grey, dissolve 4 kilogr. of Gambia cachou in 24 litres of wood spirit, and add 1·780 litres of gum water for each 1·780 litres of the cachou solution: the grey color is finally obtained by the addition of 0·060 kilogr. of green vitriol.

This color requires most particularly to be steamed, as the green and other steam colors, which are easily affected, would be changed by the acetic acid, which is otherwise carried off in the form of steam.

On Some Phenomena of Defective Vision. *By* R. T. CRANMORE.*

One of the earliest evidences of old age creeping on is experienced in defective vision; and some months ago my attention was directed to a peculiarity in the phenomena attending it which I do not recollect to have seen noticed in books. It may possibly be peculiar to my own eyes: but I think not; for though there is a difference between my left and right, from long habit of using microscopes, still the general result is similar in each, and I think such as must be detected by other persons.

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* From the London, Edinburgh, and Dublin Philosophical Magazine, vol. xxxvi.

I made a small square bounded by narrow lines on a sheet of paper, and closing my left eye, I observed that the image was double, the false one being raised, and to the left of the true the interval filled up with a pale reddish-brown spectrum, most intense near the true image; the breadth of the interval about 0·03 inch. With my right eye closed, the image was, as I expected, to the right and above, (in both instances towards the brow and nose,) and the interval similarly tinged, but fainter, and 0·025 inch wide.

I then took a slip of card, and made with a pen-knife a fine slit in it, and looked through it held horizontally at the square; the upper false image was no longer visible, the upper and lower sides of the square clearly defined, but the lateral sides were unchanged; on holding the slit vertically, the lateral false images disappeared and the upper and lower returned. Similar appearances occurred with the other eye.

I now took a card and made two fine pin-holes exactly in the positions of the centres of my pupils, and I found that I saw the true image as correctly as I had ever done in my life; in fact, it supplied the place of a pair of spectacles; the square, of course, being seen under a greater angle, appearing magnified. By making the pin-hole larger or smaller, the focal distance, if I may use the expression, increased or diminished proportionably. I beg further to remark, that in the sunshine I can read small print at the natural focal distance; it is only in fainter light that the double image and confusion of letters occur. Now a flattening of the cornea won't explain all this: it seems to have a more intimate connexion with some want of contractility engendered in old age in the iris. I am curious to obtain an explanation, and send this notice to you for the purpose of eliciting one.

P. S. I have since observed that wire-gauze, the wire being very fine, and the meshes about $\frac{1}{50}$th of an inch in diameter, when worn close to the eye, enables me to read small print with tolerable facility at a distance of five or six inches; when the meshes are closer, I can see the most minute objects with remarkable distinctness.

Brompton, *May* 4, 1850.

On the Application of Electro-Magnetism as a Motive Power. By Mr. Robert Hunt.*

A voltaic current produced by the chemical disturbance of the elements of any battery, no matter what its form may be, is capable of producing by induction a magnetic force, *this magnetic force being always in an exact ratio to the amount of matter* (*zinc, iron, or otherwise*) *consumed in the battery.*

Several forms of the voltaic battery were explained, particularly those of Daniell, Grove, Bunsen, and Reinsch, the latter being constructed without metals, depending entirely on the action between two dissimilar fluids, slowly combining.

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* From the London Artizan, for July, 1850.

The author had, however, proved, by an extensive series of experiments, that the greatest amount of magnetic power is produced when the chemical action is the most rapid. Hence, in all magnetic machines, it is more economical to employ a battery under an intense action, than one in which the chemical action is slow. It has been proved by Mr. Joule, and most satisfactorily confirmed by the author, that one-horse power is obtainable in an electro-magnetic engine, the most favorably constructed to prevent loss of power, at the cost of 45 pounds of zinc, in a Grove's battery, in 24 hours; while 75 pounds are consumed in the same time to produce the same power in a battery of Daniell's construction. The cause of this was referred to the necessity of producing a high degree of excitement, to overcome the resistance which the molecular forces offer to the electrical perturbations, on which the magnetic force depends.

It was contended, that although we have not perhaps arrived at the best form of voltaic battery, yet that we have learnt sufficient of the law of electro-magnetic forces to declare that, under any conditions, the amount of magnetic power would depend on the change of state—consumption of an element—in the battery, and that the question resolved itself into this:—

What amount of magnetic power can be obtained from an equivalent of any material consumed?

The following were regarded as the most satisfactory results yet obtained:—

1. The force of voltaic current being equal to 678, the number of grains of zinc destroyed per hour was 151, which raised 9000 pounds one foot high in that time.

2. The force of current being, relatively, 1300, the zinc destroyed in an hour was 291 grains, which raised 10,030 pounds through the space of one foot.

3. The force being 1000, the zinc consumed was 223 grains; the weight lifted one foot 12,672 pounds.

The estimations made by Messrs. Scoresby and Joule, and the results obtained by Œrsted, and more recently by Mr. Hunt, very nearly agree; and it was stated that one grain of coal consumed in the furnace of a Cornish engine lifted 143 pounds one foot high, whereas, one grain of zinc consumed in the battery lifted only 80 pounds. The cost of one hundred weight of coal is under 9 pence; the cost of one hundred weight of zinc is above 216 pence. Therefore, under the most perfect conditions, magnetic power must be nearly 25 times more expensive than steam power.

But the author proceeded to show that it was almost proved to be an impossibility ever to reach even this condition, owing, in the first place, to the rate with which the force diminishes through space. As the mean of a great many experiments on a large variety of magnets, of different forms and modes of construction, the following result was given:—

Magnet and armature in contact, lifting force, 220·0 pounds.
" distant $\frac{1}{250}$ of an inch, 90·6 "
" " $\frac{1}{125}$ " 50·7 "
" " $\frac{1}{63}$ " 50·1 "
" " $\frac{1}{50}$ " 40·5 "

Thus at one-fiftieth of an inch distance four-fifths of the power are lost.

This great reduction of power takes place when the magnets are stationary. The author then proceeded to show that the moment they were set in motion, a great reduction of the original power immediately took place; that, any disturbance produced near the poles of a magnet diminished, during the continuance of the motion, its attractive force.

The attractive force of a magnet being 150 pounds when free of disturbance, fell to one-half, by occasioning an armature to revolve near its poles.

Therefore, when a system of magnets which had been constructed to produce a given power is set in revolution, every magnet at once suffers an immense loss of power, and consequently their combined action falls, in practice, very far short of their estimated power. This fact has not been before distinctly stated, although the author is informed that Jacobi observed it.

And not merely does each magnet thus sustain an actual loss of power, but the power thus lost is converted into a new form of force, or rather becomes a current of electricity, acting in opposition to the primary current by which the magnetism is induced.

From an examination of all these results, Mr. Hunt is disposed to regard electro-magnetic power as impracticable, on account of its cost, which must necessarily be, he conceives, under the best conditions, 50 times more expensive than steam power.

The Chairman agreed with Mr. Hunt in his conclusion of the improbability of any result being obtained from electro-magnetism which could enable it to compete with steam as a motive power. At any rate, the point to which the attention of engineers and experimentalists should be turned at the present was, not the contriving of perfect machines for applying electro-magnetic power, but the discovery of the most effectual means of disengaging the power itself from the conditions in which it existed stored up in nature. Mr. Faraday assured us that in a single drop of water is contained as much electricity as is developed in a thunder storm. The portion of this which we can liberate by any existing battery is very small; so small that, as shown by Mr. Hunt's paper, its practical use cannot be profitable. The study of electro-chemistry, he thought, was a more promising field, and one from which might, at a future time, be developed a power which should supersede even steam.—*Proc. Soc. Arts, May* 22, 1850.

Description of an Apparatus for Regulating the Heat Produced by a Gas-Burner. By Alexander Kemp.*

Any one who has had occasion to maintain an object at a regulated temperature for a length of time by means of a gas-burner, must have experienced the difficulty of keeping the heat at the required point from two causes. First, the quantity of gas passing through the burner in any given time varies directly as the pressure on the service-pipes; a greater quantity is therefore consumed when the pressure increases, and the amount of heat applied to the object is increased in the same degree.

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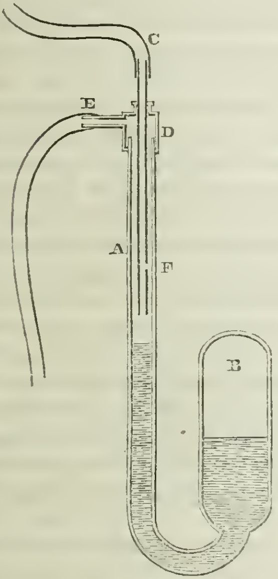
* From the London, Edinburgh, and Dublin Philosophical Magazine, vol. xxxvi.

Secondly, as the temperature of the atmosphere is liable to change during the continuance of the experiments, its cooling influence will be greater at one time than another. Both these causes conduce to render the attainment of the object in view one of considerable difficulty.

It will be evident, from what I have just stated, that any instrument intended to supply the desideratum must be self-acting, and must supply the gas to be consumed exactly as it is required. The instrument I have been in the habit of using for some time back consists of an air-thermometer. AB, containing mercury in the lower part of bulb B and part of the stem A. A tube of smaller diameter, marked C, passes down the axis of the tube A, the annular space being made air-tight by a small brass stuffing-box, D, by means of which it may be retained at any required elevation. In using the instrument, the bulb B is placed in the same situation as the body to be exposed to the heat of the gas-flame; for instance, if it is a water-bath containing vessels or other objects, it is immersed in the water; or if an air-chamber or hot-press, it is placed as near the object as possible, so that the air in the bulb may attain the same temperature as the surrounding medium.



A tube of vulcanized Indian rubber is now to be connected with a stop-cock attached to the service-pipe, and its other extremity drawn over the end of the pipe C, which will make it sufficiently air-tight. A second India rubber tube is in like manner to be attached at E, to convey the gas to the burner employed as a source of heat in the operation.

Let us now suppose that it is required to keep an object at a temperature of 100° F., the bulb of the instrument being placed contiguous to the object; the stop-cock is to be opened so as to allow a free supply of gas to the burner, which is now to be kindled; the heat now begins to act on the air contained in the ball of the instrument, causing it to expand and force the mercury up the stem A; when it is found, by the use of a common thermometer, that the heat has risen to 100°, the tube C is to be pushed down till its lower extremity is immersed in the mercury. This would, of course, cause the flame to be extinguished; but, to prevent this occurring, a small hole is bored through the inner tube opposite F, which permits a small quantity of gas to pass to the burner. As the passage of the gas is now interrupted, the source of heat is withdrawn, and the cooling influence of the surrounding air comes into play, which will cause the air contained in B to contract and the mercury to sink in A, leaving the end of C uncovered, and thus open a free passage to the gas, which by its combustion would again raise the temperature so as to cut off the supply; but in a very short time these two opposing forces come to an equilibrium, and the flame scarcely varies in size.

After trying the instrument in the form described, I experienced a practical difficulty from the want of perfect contact between the end of the tube C and the mercury, from which I found that it might rise many degrees beyond the assigned limit without sufficiently lowering the flame; this I at once saw might be overcome by making the tube of a substance which would become *wetted* by the mercury. I tried a brass and also a copper tube, amalgamated at the end, but they slowly dissolved in the mercury, which they rendered impure, so that its rise and fall could not be depended on with the required nicety. The substance now used is platinum, of which about half an inch of the lower end of the tube is formed, amalgamated by dipping it into a liquid amalgam of sodium and mercury. In connexion with this I may mention, that platinum, iron, and steel, may be readily amalgamated in the same way, or by using a strong solution of caustic potash or soda in contact with the mercury.

I have now used several of these instruments for various periods, and have found them to answer well. In one operation, conducted in Professor Gregory's laboratory (the fermentation of sugar into butyric acid), one of them has been in use for upwards of six weeks, keeping about five gallons of liquid at a temperature of 98° F., and it has not been observed to vary. I have also another in an apparatus for artificial incubation, where the temperature in the well part is kept at 120° F. For this latter purpose I consider it well adapted, as it may be placed in the vessel along with the eggs, and thus the use of hot water be altogether dispensed with, as well as the constant attendance required to regulate the heat applied to the eggs.

I need not take up space with pointing out many applications that may be made of the instrument; these will occur to every one: but there is one I may allude to, viz., obtaining products of the decomposition of organic bodies at fixed temperatures, which has hitherto been somewhat difficult, as different substances are formed as the temperature varies to which they are subjected. The only limit to its application is the same as in the ordinary thermometer, viz., the boiling of the mercury; this might be overcome by using an easily fusible metal, such as tin, and constructing the instrument of iron, when its form might also be modified to suit particular circumstances.—*From the Chemical Gazette for May* 15, 1850.

Improvements in the Manufacture of Steel, Patented by JOSIAH MARSHALL HEATH, *of Hanwell, Middlesex county, England, September* 6, 1849.*

My invention consists in the application of iron, produced from iron ores without being brought to the state of pig or cast-iron, to the manufacture of steel, the iron so produced being manufactured by a peculiar process discovered by me, which renders it more suitable for conversion into steel, than any iron hitherto made by the processes actually in use.

I have found that the excellence of steel depends upon the comparative purity or freedom from mixture with extraneous substances of the iron from which it is made.

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* From the London Repertory of Patent Inventions, May 1850.

All iron made by smelting the ores of that metal in a blast furnace contains impurities, in consequence of the alloys formed between the fluid metal and the earthy alkaline or other extraneous substances contained in the ores, the fuel, and the matters used to flux the ores.

These impurities can never be completely removed from the metal by the operations in use for converting the pig into malleable iron.

All the iron used for conversion into steel in this country is made from pig-iron, and, consequently, contains more or less impurity. The nearest approach that can be made to the production of absolutely pure iron, is by deoxidating pure iron ores by the well known process of cementation with carbon; I have found, however, that the metallic product so obtained upon a manufacturing scale, is totally unfit for the production of good steel, without further preparation; but that when subjected to the treatment hereinafter described, the result is an iron fit for making steel of finer quality than that now made from the best foreign iron. Any pure ore or oxide of iron from which the earthy or other extraneous matters can be easily separated by the mechanical operations of crushing, winnowing, washing, or magnetic attraction, may be treated in the manner I propose, but I prefer the magnetic ore of iron to all others. The ore is to be reduced to the state of grains, or even of fine powder, in order to facilitate the separation from it of the earthy or other extraneous substances, the pure ore is then to be reduced to the metallic state by any of the well known processes for depriving the metal of oxygen by acting upon it with carbon or any other reducing agent at a heat below that required to bring the metal to the fluid state. The metallic product obtained in this way, when operating upon a manufacturing scale, can never be obtained absolutely free from the last portions of earthy or other impurity, and always contains some portion of oxide of iron, which renders it quite unfit for conversion into steel of good quality, as it comes from the process of deoxidation without further treatment.

To make a perfect steel iron, I take the metallic product as it comes from the process of cementation or deoxidation, and mix it with a small portion of oxide or chloride of manganese, and a certain portion of coal or fir tar, or any cheap hydrocarbon or carbonaceous matter. I do not confine my invention to the use of any fixed proportions of these substances, for the proportions to be employed in each case will vary with the varying conditions of the mass, as the more or less perfect of the oxide, and the quantity of resident carbon mixed with it, but I have obtained the best results from the mixture of from one to three pounds of oxide or chloride of manganese, and from one to two gallons of coal or other tar to each one hundred pounds of deoxidated ore.

This mixture of granular iron, tar and manganese, resulting from this process, is heated in a suitable furnace, and when the iron is at a welding heat, it is removed from the furnace, and subjected to the action of some suitable instrument of compression, in order to be formed into a solid bloom by any of the usual processes now in use.

The bloom is then to be reheated and shingled, hammered, or rolled into bars in the usual manner. The bar-iron so produced is to be converted into steel by the well known processes now in use, and its quality will be found superior to that made from the best iron hitherto procurable.

I do not claim as my invention any process or apparatus for reducing iron ores to the metallic state by cementation or deoxidation.

But what I do claim as my invention is,

The treatment of the metallic product obtained from iron ores by deoxidation in the manner above described, and the application of the iron so produced to the manufacture of steel by whatever means the conversion of the said iron into steel may be effected.

On Alloys of Copper and Tin, and the Manner in which they behave when heated. By M. C. J. B. KARSTEN.[*]

In the experiments undertaken by M. Karsten, alloys were formed by melting together 100 parts of tin, and 50, 100, and 200 parts of copper respectively. These alloys remained perfectly homogeneous, not only in the fluid state, but also after cooling, either slowly or very quickly, the three compounds were brittle and white. Their perfect homogeneity left no doubt of their being chemical compounds of copper and tin, and, consequently, compounds having definite proportions, even after cooling. These compounds did not undergo any change on being afterwards submitted to heat.

On increasing the per centage of copper, so as to combine 100 parts of tin with 400 of copper, the alloy obtained presented, on being allowed to cool very slowly in the crucible, a reticulated sieve-like appearance, and a close grain: it had a dirty white color, and was somewhat brittle. When this alloy was poured quickly into a cold iron ingot-mould, it retained its properties; no change, therefore, appeared to take place, either by slow or rapid cooling. But when it is raised to a red heat, and run into moulds, the retention of the properties which it possessed before the application of heat, or, on the other hand, the formation of an alloy, of a yellowish-white color, ductile and of granular texture, will depend upon the mode of cooling adopted. This latter quality is produced when the hot compound is suddenly cooled by plunging it into water; while the primitive compound is produced by slowly cooling in the air. If, on heating, the temperature be raised a little too high, small silver-white globules will exude from the still solid mass; but these will disappear on continuing the heating until the whole mass becomes liquid. These phenomena, produced by the application of heat, and also the non-homogeneous quality of the alloy, which has been suddenly cooled down from a red heat, evidently show that, at a temperature not sufficiently high to produce fusion, the mixture undergoes another change as to proportions; as it forms a combination of a more fluid nature than a compound containing more tin and less copper, which compound is destroyed by slow cooling, but which still exists on cooling quickly in water, as the alloy solidifies too quickly to allow the primitive general combination of the two metals again to take place. These modifications do not present themselves in all alloys wherein copper greatly predominates, because their great fluidity renders a change in their properties impossible.

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[*] From the Lond. Journ. Arts, Sciences, and Manufactures, October, 1850.

On the same principle, in any alloy consisting of 100 parts of tin and 400 of copper, the primitive general combination of the two metals is completely re-formed by cooling slowly from a red heat. These changes in the proportions, owing to a difference in the degree of temperature and the method of cooling the heated mass, perfectly explain why this alloy behaves, as regards ductility under the hammer, at a red heat, exactly in the same manner as after sudden cooling; and also why this slowly-cooled alloy, and that which was not carried to a red heat, are both brittle, and will not work under the hammer.

On increasing still further the per centage of copper, by combining, for instance, 100 parts of tin with 1100 parts of copper (which proportions are usually employed for gun metal,) properties of a totally different nature are presented. By very slowly cooling the alloy in a state of fusion, it appears to the naked eye perfectly homogeneous; but on applying a lens, the faces of a recent fracture will lose this appearance, and a white metallic alloy will be seen to have been detached in the midst of the reticulated faces of another alloy, of a reddish-yellow color. On being wrought and polished, the surface, however, appears homogeneous, as the tenacious reddish-yellow alloy prevents the white friable compound, which is dispersed in small grains throughout the mass, from being apparent.

On causing a sudden cooling or solidification of the fluid alloy, in the form of small ingots, by pouring it into an iron ingot-mould as thick as possible, and in a cold state, a homogeneous combination is formed, the fracture of which does not present any heterogeneity; the alloy therefore remains as homogeneous as in the fluid state. If the ingot be heated to an intense and continuous red heat, and in that state be plunged into water, it retains its homogeneous character; whilst, if cooled very slowly in the air, it acquires the property of the liquid alloy slowly cooled in the air: that is to say, a granular white compound is produced, which is deposited in the midst of a reddish-yellow reticulated mass. This compound, cooled slowly, behaves in exactly the same manner at a sustained red heat. If plunged into water at a red heat, it is homogeneous—if slowly solidified, it preserves its heterogeneity.

An alloy composed of 100 parts of tin and 1100 parts of copper can only be homogeneous at an elevated temperature; that is to say, at the temperature of fusion, or at an intense red heat.

If the temperature be lowered; at least two combinations are formed—the compound which is thus solidified, being a mixture of two compounds, having definite chemical proportions:—their formation may be prevented by sudden cooling. This metallic mixture, on being heated, behaves in a very different manner from d'Arcet's alloy; and this difference is a consequence of the change in the proportion of the tin to the copper; which proportion in d'Arcet's compound, is sufficiently considerable to cause the former metal to remain united with the copper at any temperature; but, at a red heat, gives rise to two combinations, which destroy each other, both at the temperature of fusion and at the ordinary temperature. The alloy, constituting gun-metal, contains so little tin, that the two metals require to be at the temperature of fusion, or at a very elevated temperature, to remain in combination ; on lowering the temperature, they will separate, and this can only be prevented by sudden cooling. Cannons, cast in gun-metal, do not, therefore, any more than cast-iron guns, consist of two metals, in chemical combination, but of a mixture of at least two compounds of copper and tin, mechanically set, as it were, into each other. An alloy, consisting of 100 parts of tin and 1100 parts of copper, could not therefore be a homogeneous compound, unless it were possible to cool and solidify the fluid mixture momentarily, or to expose the castings, after having been slowly cooled, to a red heat, and then cool them suddenly in water. But these two methods are impracticable, by reason of the great bulk of the castings : the only practicable method being, to allow the pieces to cool slowly in the mould. If the substance of which the mould is formed is an excellent conductor of heat, then the compound, which has lost much of its fluidity, is quickly brought to the solid state, and an instructive phenomenon takes place ; which is, that after the metal has coagulated in the mould, the compound possessing the greatest degree of fluidity rises, and boils in the "gate." Instead of contracting, on solidification, this compound appears rather to expand, as it is seen to rise in the mould. On examining the condition of a piece of cannon, thus cooled, it will be found that the surface of the fractures is full of holes and bubbles, and that the piece is not fit for service. M. Karsten states that he found a dilated alloy of this kind, which was of a white color, and very brittle, composed of 21 parts of tin and 79 of copper.

If the moulding sand be surrounded, as is now done in the new processes of casting, with cast-iron moulds, these latter acquire a very high temperature after running the metal ; and as soon as the above-mentioned phenomenon of the rising of the most fluid portion of the alloy takes place. But if the old method of moulding in clay be adopted, or if a substance be employed in the mould of as low a conducting power, and as dense and little porous as poseible, the iron mould will not become heated, and the metal will shrink and coagulate without this phenomenon taking place ; the alloy will remain fluid during a much greater length of time, so that the least fusible compound will not solidify at the moment of moulding, but will remain in combination with the more fluid and still hot portion ; from which results a more regular deposit of the alloys one upon the other. These two alloys may be very distinctly seen with the naked eye, on examining a recent fracture.

The chemical composition of the least fluid combination cannot be easily determined, as it is impossible to separate the red and tenacious compound from the white and brittle one with which it is intermixed. The latter compound may, however, be obtained in a state of purity, as by reason of its greater fluidity it is separated in the mould when the less fluid portion solidifies, so as to be free from all mechanical mixture. It is white, hard, and brittle, and has received the name, from German casters, of *krätz mĕtal*, (waste metal:) M. Karsten found its composition to be 17·7 parts of tin and 82·3 parts of copper.

A variety of easily fusible compounds of tin and copper, possessing definite proportions, are therefore capable of formation, in which the per centage of copper augments proportionably to the speed at which the cooling is effected. Under these circumstances it may be well to explain the fact, which the experiments of artillery officers have proved, viz: that pieces of large calibre are not so durable as those of less calibre, although the composition of the alloy, and the operation of moulding them, may have been the same. The bore of pieces of large calibre is of softer metal, and consequently increases in diameter more rapidly by use than those of smaller calibre; because the large pieces necessarily take a much longer time in cooling, and the more fluid part of the mass, formed in this slow cooling, contains less tin, and is consequently softer than the alloy, which is as fluid, but is more rapidly cooled. These phenomena also lead to the following result, viz: that not only are the combinations of the alloys determined, in many cases, by differences of temperature; but also the compounds, already formed, may undergo a change, by merely raising the temperature, without its being requisite to bring the compounds to a fluid state, and without any disengagement of gaseous matter.—[*Technologiste.*]

Description of Improvements in Producing Ornamental Designs on Papier-Maché, and in Preserving Vegetable Matters. Patented by WILLIAM BRINDLEY, *Twickenham, England, May,* 1850.*

The first part of this invention consists in an improved mode of producing ornamental designs on papier-maché.

The patentee takes the sheets of wet paper, as they come from the sieve, and places them one upon another until he has obtained the desired thickness; then before pressing them, he places the accumulated mass of sheets upon the oiled pattern, and lays a sheet of water-proof paper (oiled paper) on the top thereof, and on it several more sheets of wet paper; after which he subjects the whole to pressure; and then he clamps the whole together and stoves the same. The object of applying the wet paper to the pattern (before being pressed) is in order that such materials as leaves and flowers of plants and trees may be used as the pattern surface or part of the pattern surface: which materials, being very delicate, would not admit of the "green" paper being used after being pressed. In preparing the pattern surface, the patentee prefers to employ panel board, on which he places the leaves or flowers of plants or trees (such matters being well oiled,) and then on them he lays the sheets of wet paper.

The second part of the invention consists in an improved method of preserving vegetable matters, such as the leaves, stalks, and flowers of plants, by oiling them, and then placing the same between sheets of paper and stoving them in the same manner as articles made of papier-maché: the patentee employs a temperature of from 250° to 300° Fahr.

The patentee claims as his invention, Firstly,—the producing ornamental surfaces on papier-maché, by employing unpressed wet paper;

*From the London Journal of Arts and Sciences, May, 1850.

and also the employment of the leaves of plants or flowers, or parts thereof, in making ornamental surfaces in papier-maché. Secondly,—the preserving of vegetable matters, such as the leaves, stalks, and flowers of plants.

Translated for the Journal of the Franklin Institute.

Experiments on the Tenacity of the Principal Malleable Metals, made at Temperatures 0°, 100° *and* 200° *Cent.* (32, 212° *and* 392° *Fahr.*) *by M. Baudrimont.*

In 1843, I undertook the experiments on the tenacity of metals, at the temperatures 0°, 100°, and 200° (cent.) which are the subject of the present memoir.

The metals submitted to experiment were copper, gold, platina, silver, palladium, and iron, wire.

These wires were stretched horizontally in baths of melting ice, boiling water, and oil heated to 200° cent. (392° Fahr.)

The traction was exercised by dry sand, which flowed slowly into a vessel which received it. The flow could be stopped at pleasure. As soon as the wire broke, the vessel falling, started a spring, which instantly stopped the flowing of the sand.

The vessel, the sand which it contained, and the hook which carried it were then weighed in an excellent balance.

The results thus obtained are consigned in the following table:

Tenacity of the Principal Malleable Metals, at the temperatures 0°, 100°, *&* 200°, (*Cent:*) *for diameters and sections determined by experiment*; *and for a square millimetre of section found by calculation.*

Metals.	Diameter at 16° C. (60·8° F.)	Area of the cross section.	Maxima and Means.	Tenacity.			Tenacity per sq. millim: of cross section.		
				0°	100°	200°	0°	100°	200°
	mm.	sq. mm.		kil.	kil.	kil.	kil.	kil.	kil.
Gold,	0·41250	0·13364	Max'a.	2·546	2·107	1·750	19·051	15·766	13·094
			Means.	2·459	2·035	1·722	18·400	15·224	12·878
Platina,	0·41000	0·13202	Max'a.	3·040	2·696	2·392	23·026	20·421	18·118
			Means.	2·987	2·546	2·281	22·625	19·284	17·277
Copper,	0·48000	0·18095	Max'a.	4·585	3·990	3·590	25·338	22·050	19·839
			Means.	4·542	3·958	3·296	25·100	21·873	18·215
Silver,	0·39825	0·12456	Max'a.	3·546	3·055	2·329	28·620	24·526	18·705
			Means.	3·528	2·898	2·314	28·324	23·266	18·577
Palladium,	0·39750	0·12409	Max'a.	4·590	4·083	3·625	36·983	32·871	29·212
			Means.	4·527	4·031	3·360	36·481	32·484	27·077
Iron,	0·17500	0·02405	Max'a.	5·046	4·835	5·130	209·813	201·039	213·305
			Means.	4·940	4·611	5·057	205·405	191·725	210·270

[Note.—The French millimetre is 0.0391 of an inch, and consequently the square millimetre is 0.00155 square inch. The kilogramme is 2.205 lbs. avoirdupois, and the degree of the Centigrade thermometer equal to 1·8° of Fahrenheit, the zero of the Centigrade corresponding to 32° Fahrenheit.]

From the experiments here recorded it results,

1st. That the tenacity of the metals varies with the temperature.

2d. That in general it decreases, as the temperature rises; but this is not without exceptions.

3d. That in the case of silver, it diminishes more rapidly than the temperature.

4th. That for copper, gold, platina, and palladium, it decreases more slowly than the temperature.

5th. That iron presents a very remarkable peculiarity. At 100° (212° Fahr.) its tenacity is less than at 0°; (32° Fahr.) but at 200° (392 Fahr.) it is greater than at this latter temperature.

—Comptes Rendus of the Academy of Sciences at Paris, 29 July, 1850.

Description of Improvements in Coating the Surfaces of Pumps, Pipes, Cisterns, and other articles of Iron. Patented by William Wyatt, *of the County of Worcester, England, April,* 1850.*

This invention consists in coating cast iron pumps, cast iron pipes, cast iron cisterns, and other articles of cast iron, with a glass or glaze.

The glass is composed of lead, borax, and silex, which are combined in the proportion of three parts, by weight, of white lead (or one part of red lead and two parts of white lead,) two parts of borax, and one part of calcined flint. These ingredients, being well mixed together, are to be fused in a crucible, run into water, and then ground with water in a glaze mill; and when the mixture is thoroughly reduced, so that it will readily pass through a silk or lawn sieve, such as is used by china manufacturers, it will be ready for use: it is not absolutely necessary to fuse the materials; but it is better to do so. The glaze thus prepared, being about the consistence of cream, is applied to the inner surfaces of pump barrels, pipes, and similar articles of cast iron, by closing one end, introducing a quantity of glaze, turning the article round, so as to coat the interior uniformly with the glaze, and then pouring out the surplus. The interior of cisterns and like articles of cast iron is coated in a similar manner, by introducing a quantity of glaze and moving the article about in various directions until the interior is uniformly coated. In general it will only be necessary to scour and wash the surface, previous to coating; but if the surface is much oxidized, it is requisite to subject the articles to a red heat, and, when cool, to scour them well with water. It is preferred to warm the metal before the application of the glaze, in order to facilitate the drying of the latter. The exterior surfaces of articles of cast iron may be coated by dipping the articles into the semi-fluid glaze, or by applying the glaze thereto with a brush.

After the pumps, pipes, cisterns, or other articles of cast iron have received a coating of glaze, they are to be subjected to a suitable temperature for firing the glaze, and thereby causing it to adhere. This is effected by placing the articles in a kiln heated in such manner that no flame or sulphur shall come in contact with the articles. The heat is gradually raised until the glaze melts (which can be seen by taking out a brick from an opening in the kiln); and, so soon as the melting of the glaze takes place, the fires are drawn, and the articles are allowed to cool: when the articles have become cool, they are removed from the kiln, and are ready for use.

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* From the London Journal of Arts and Sciences, May, 1850.

The patentee does not confine himself to the precise quantities of the matters above mentioned, nor to the precise details of the above described process; but what he claims as his invention is, the coating with a glaze, such as above explained, the surfaces of cast iron pumps, cast iron pipes, cast iron cisterns, and other articles made of cast iron.

Extracts from the Address of the President (Sir David Brewster) *before the first general Meeting of the British Association for the Advancement of Science, held July* 31*st*, 1850.

"The other object of the British Association, mentioned by Mr. Harcourt, the Organization of Science as a National Institution, is one of a higher order, and not limited to individual, or even to English, interests. It concerns the civilized world; not confined to time, it concerns eternity. While the tongue of the Almighty, as Kepler expresses it, is speaking to us in His Word, His finger is writing to us in His works; and to acquire a knowledge of these works is an essential portion of the great duty of man. Truth secular cannot be separated from truth divine; and if a priesthood has in all ages been organized to track and exemplify the one, and to maintain, in ages of darkness and corruption, the vestal fire upon the sacred altar, shall not an intellectual priesthood be organized to develope the glorious truths which time and space embosom—to cast the glance of reason into the dark interior of our globe, teeming with what was once life—to make the dull eye of man sensitive to the planet which twinkles from afar, as well as to the luminary which shines above—and to incorporate with our inner life those wonders of the external world which appeal with equal power to the affections and to the reason of immortal natures. If the God of Love is most appropriately worshipped in the Christian temple, the God of Nature may be equally honored in the Temple of Science. Even from its lofty minarets the philosopher may summon the faithful to prayer; and the priest and the sage may exchange altars without the compromise of faith or of knowledge. Influenced, no doubt, by views like these, Mr. Harcourt has cited the opinions of a philosopher whose memory is dear to Scotland, and whose judgment on any great question will be everywhere received with respect and attention; I refer to Prof. Playfair, the distinguished successor in our Metropolitan University of the Gregorys, the Maclaurins, and the Stewarts of former days, who in his able dissertation "On the Progress of the Mathematical and Physical Sciences" thus speaks of the National Institute of France:

"This institution has been of considerable advantage to science. To detach a number of ingenious men from every thing but scientific pursuits—to deliver them alike from the embarrassments of poverty and the temptations of wealth—to give them a place and station in society the most respectable and independent, is to remove every impediment, and to add every stimulus to exertion. To this institution, accordingly, operating upon a people of great genius and indefatigable activity of mind, we are to ascribe that superiority in the mathematical sciences which, in the last seventy years, has been so conspicuous."—*Diss. 3d, sec.* 5, *p.* 500.

This just eulogy on the National Institute of France, in reference to abstract mathematics, may be safely extended to every branch of theoretical and practical science; and I have no hesitation in saying, after having recently seen the Academy of Sciences at its weekly labors, that it is the noblest and most effective institution that ever was organized for the promotion of Science. Owing to the prevalence of scientific knowledge among all classes of the French population, and to their admirable system of elementary instruction, the advancement of science, the diffusion of knowledge, and the extension of education are objects dear to every class of the people. The soldier as well as the citizen—the Socialist—the Republican and the Royalist—all look up to the National Institute as a mighty obelisk erected to science, to be respected and loved and defended by all. We have seen it standing unshaken and active amid all the revolutions and convulsions which have so long agitated that noble but distracted country—a common centre of affection, to which antagonist opinions and rival interests and dissevered hearts have peacefully converged. It thus becomes an institution of order, calculated to send back to its contending friends a message of union and peace, and to replace in stable equilibrium the tottering institutions of the State. It was doubtless with views like these that the great Colbert established the Academy of Sciences in Paris, and that the powerful and sagacious monarchs on the Continent of Europe have imitated his example. They have established in their respective capitals similar institutions—they have sustained them with liberal endowments—they have conferred rank and honors on their more eminent members, and there are now here present distinguished foreigners who have well earned the rewards and distinctions they have received. It is, therefore, gentlemen, no extravagant opinion that institutions which have thus thriven in other countries should thrive in ours—that insulated societies, which elsewhere flourish in combination, should, when combined, flourish among us—and that men ordained by the State to the undivided functions of science should do more and better work than those who snatch an hour or two from their daily toil or from their nightly rest. In a great nation like ours, where the higher interests and objects of the State are necessarily organized, it is a singular anomaly that the intellectual interests of the country should, in a great measure, be left to voluntary support and individual zeal—an anomaly that could have arisen only from the supineness of ever-changing administrations, and from the intelligence and liberality of a commercial people—an anomaly, too, that could have been continued only by the excellence of the institutions they have established."

"Our English friends are, we believe, little aware of the obstructions which oppose the progress of science in Scotland. In our five universities there is not a single Fellowship to stimulate the genius and rouse the ambition of the student. The church, the law and the medical profession hold out no rewards to the cultivators of mathematical and physical science; and were a youthful Newton or Laplace to issue from any of our universities, his best friends would advise him to renounce the divine gift, and to seek in professional toil the well-earned competency which can alone secure him a just position in the social scale and an enviable felicity in the domestic circle. Did this truth require any evidence in its support, we find it in the notorious fact that our colleges cannot furnish professors to fill their own important offices; and the time is not distant when all our chairs in Mathematics, Natural Philosophy, and even Natural History, will be occupied by professors educated in the English universities. But were a Royal Academy or Institute, like that of France, established on the basis of our existing institutions, and a class of resident members enabled to devote themselves wholly to science, the youth of Scotland would instantly start for the prize, and would speedily achieve their full share in the liberality of the State. Our universities would then breathe a more vital air. Our science would put forth new energies, and our literature might rise to the high level at which it stands in our sister land. But it is to the nation that the greatest advantages would accrue. With gigantic manufacturing establishments, depending for their perfection and success on mechanics and chemistry —with a royal and commercial marine almost covering the ocean—with steamships on every sea—with a system of agriculture leaning upon science as its mainstay—with a net-work of railways demanding for their improvement, and for the safety of the traveler, and for the remuneration of their public-spirited projectors, the highest efforts of mechanical skill,—the time has now arrived for summoning to the service of the State all the theoretical and practical wisdom of the country—for rousing what is dormant, combining what is insulated, and uniting in one great institution the living talent which is in active but undirected and unsupported exercise around us.—*Proceedings of the British Association, July 31st*, 1850.

On the Laws of the Elasticity of Solids. By W. J. Macquorn Rankine.*

The object of this paper is to investigate the relations which must exist between the elasticities of different kinds possessed by a given solid substance, and between the different values of these elasticities in different directions. The different kinds of elasticity possessed by a solid substance are distinguished into three: first, *longitudinal elasticity*, representing the forces called into play in a given direction by condensation or dilatation of the particles of the body in the same direction;—secondly, *lateral elasticity*, representing the force called into play in a given direction by condensation or dilatation of the particles of the body in a direction at right angles to that of the force;—and thirdly, *transverse elasticity* or *rigidity*, being the force by which solid substances resist distortion or change of figure, and the property which distinguishes them from fluids. The author's researches refer chiefly to substances whose elasticity varies in different directions. His first endeavor is to determine the laws of elasticity of such substances, as far as they are independent of hypotheses respecting the constitution of matter,—a method which has not hitherto been followed. The first proposition respecting such substances is the following:—*Theorem* 1. In an elastic substance which is homogeneous and symmetrical with respect to molecular action, there are three directions at right angles to each other, in which a longitudinal strain (viz., dilatation or condensation) produces a pressure in its own direction. These three directions are called axes of elasticity. They are the proper directions for the reduction of all molecular displacements and pressures. Their existence has been demonstrated according to various hypotheses as to the constitution of matter; but the truth of the demonstrations is independent of the particular hypotheses. The elasticity of a body, referred to these three axes, is expressed by twelve coefficients—three of longitudinal and six of lateral elasticity, and three of rigidity, which are connected by the following laws:—*Theorem* 2. The coefficient of rigidity is the same for all directions of distortion in a given plane:—*Theorem* 3. In each of the co-ordinate planes of elasticity, the coefficient of rigidity is equal to one-fourth part of the sum of the two coefficients of longitudinal elasticity, diminished by one-fourth part of the sum of the two coefficients of lateral elasticity in the same plane. The investigation having now been carried as far as is possible without the aid of hypotheses, the author determines, in the first place, the consequences of the supposition of Bescovich, that elasticity arises entirely from the mutual action of atomic centres of force. The author denominates bodies so constituted *perfect solids*, and respecting them proves the following propositions:—*Theorem* 4. In each of the co-ordinate planes of elasticity of a perfect solid, the two coefficients of lateral elasticity and the coefficient of rigidity are all equal to each other:—*Theorem* 5. In each axis of elasticity of a perfect solid, the coefficient of longitudinal elasticity is equal to three times the sum of the two coefficients of rigidity for the co-ordinate planes which pass through that axis, diminished by three times the coefficient of rigidity for the plane normal to that axis. Thus, in perfect solids, all the coefficients of elasticity are functions of *three* independent coefficients—those of rigidity. In no previous investigation has the number of independent coefficients been reduced below six. To represent the phenomena of *imperfect* solids, there is introduced the *hypothesis of molecular vortices*, in addition to that of atomic centres; that is to say, each atomic centre is supposed to be surrounded by a fluid atmosphere, retained round the centre by attraction, and diffused from it by the centrifugal force of revolutions constituting heat. The author has already applied this hypothesis to the theory of the elasticity of gases and vapors, in a paper read to the Royal Society of Edinburgh, and published in their Transactions, vol. xx. Applied to solids, it leads to the following conclusion:—*Theorem* 6. In an imperfect solid, according to the hypothesis of molecular vortices, each of the coefficients of longitudinal and lateral elasticity is equal to the same function of the coefficients of rigidity which would be its value in a perfect solid, added to a coefficient of fluid elasticity, which is the same in all directions. Thus the number of independent coefficients is increased to four. The rest of the paper is occupied by the deduction of some important consequences from these principles. This paper is intended to form the foundation of the theoretical part of a series of researches on the strength of materials.

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* From the London Athenæum of August 10, 1850.

Sir D. Brewster begged to suggest to Mr. Rankine that by an examination of the action of transparent solids on polarized light, the correctness of these theoretic views might be tested or corrected: and so accurate and simple was this method found to be of testing the nature of the constraint under which the several elements of a strained body were, that models of pieces of carpentry were now actually constructed in glass, subjected to the kind of strain to which their representatives would be exposed; and the kind and degree at each part rigorously ascertained by polarized light.—*Ibid.*

On a New and Ready Process for the Quantitative Determination of Iron.

By DR. F. PENNY.*

The author recommends the employment of the chromate and bichromate of potash for the estimation of iron in the common ores of the metal, and especially for the analysis of the clay-band and black-band ironstone of this country. He was led to the application of these salts in the course of some recent investigations on the materials and products of the manufacture of alum from "alum-shale," in which he was much retarded by the want of a ready method for estimating the oxides of iron. The chromates of potash give very exact results, and possess the great advantage that a much larger quantity of material may be operated on than can be conveniently treated by the usual methods. For practical purposes, he says, the bichromate is to be preferred. The process requires no other apparatus than that commonly used for centigrade testing, which is familiar to all persons engaged in chemical pursuits. It may be easily and rapidly executed, occupying only a fraction of the time required for the process of estimating iron by precipitation as the sesquioxide; and it is not interfered with by the presence of alum and phosphates which usually exist in the ore. The method is based on the well known reciprocal action of chromic acid and protoxide of iron, whereby a transference of oxygen takes place, the protoxide of iron becoming converted into sesquioxide, and the chromic acid into sesquioxide of chromium.—*Ibid.*

On the Self-Imposed Taxation of the Working Classes of the United Kingdom.

By MR. G. R. PORTER.†

The object of the author is to exhibit the amount expended on three articles of luxury, the use of which he presumes might advantageously be dispensed with, viz. spirits, beer, and tobacco; the respective values of which are £24,091,458; £25,383,165; and £7,588,607, making a total of £57,063,230.

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* From the London Athenæum August 10, 1850.

† From the London Artizan, October 1, 1850.

Improvements in Certain Materials to be used in Dyeing and Printing. Patented by John Mercer *and* William Blyth, *of Lancaster county, England, October* 12, 1849.*

The nature of our said invention consists in making double salts in a solid or concrete state, composed of oxide of tin or stannic acid, and phosphoric acid, arsenic acid, or arsenious acid, and soda, which are or may be called phospho-stannate of soda, arseno-stannate of soda, &c. These concrete or dry or solid double salts we dissolve in water, and use instead of, and for all purposes for which stannate of soda is used, in dyeing and printing cottons, de laines, and other fabrics. All the double salts of phosphoric, arsenic, or arsenious acids, with stannic acid and potash, soda, or ammonia, will answer; but we prefer the arsenic stannate of soda. We make it simply by adding to stannate of soda arseniate of soda (made by fluxing or heating equal weights of white arsenic and nitrate of soda together) in such proportions as form the strongest solid or concrete salt; this is about equal equivalents of arsenic acid and stannic acid. We take one gallon of stannate of soda liquor at about fifty twaddel, and dissolve in it (in an iron vessel on the fire) one and a half pound of arseniate of soda, made as before stated; a little of the thin mixture, while hot on the fire, is taken out and dropped on a cold plate or stone. If it immediately concrete into a solid, the fluid may be poured out on any suitable bed or receptacle, when it becomes solid as soon as cold. This constitutes our solid or concrete arsenic stannate of soda. We do not confine ourselves to the above particular way of adding the arseniate or phosphate of soda (should phosphate be desired,) for the arseniate or phosphate may be added to the soda before the tin, or before the soda be made into stannate of soda. The arseniate of soda, phosphate of soda, or arsenious acid, may be added before, or along with, or after the oxide of tin or stannic acid is united to the soda, and in all cases the same arsenic stannate of soda is formed. We do not claim any particular mode of making the stannate of soda. Any of the well known ways will make a stannate suitable for our purpose, in making double salts, as here described.

But what we claim is,

The sole manufacture and use of the solid or concrete double salts, composed of arsenic acid, or arsenious acid, and stannic acid and soda, potash or ammonia and phosphoric acid, and stannic acid, and soda, potash, or ammonia.

On the Cleansing of Metal Castings.†

In the old process of cleansing metal castings from the coating of oxide and sand with which they are covered when taken from the mould, the work is thrown into water acidulated with sulphuric or hydrochloric acid, which acts upon the surface of the metal, and more or less completely removes the covering of foreign matter. The acid, however, leaves the surface rough and unequal, and it is generally necessary, after its action, to have recourse to mechanical means to effectually take away the oxide. Some time since, M. Sorel had remarked, that the cleansing of castings was more completely effected by the acidulated water produced in certain processes employed in the depuration of oils, and left as refuse, than by a mere mixture of acid and water; and, according to the experiments of MM. Thomas and Delisse, the oxide and sand are removed from cast surfaces with great certainty and facility, if, to the water acidulated with sulphuric acid, organic matter, such as glycerine, artificial tannin, naphthaline, creosote, or stearine, be added. The acid liquor, thus prepared, does not dissolve the coating of oxide, but causes it to become detached and scale off without sensibly attacking the surface of the metal beneath; there is no disengagement of hydrogen gas, as when common dilute acid is employed, even when the immersion of the metal in the bath is continued for a very considerable time; and the surface, after the operation, is uniform, quite clean, and smooth.

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* From the London Repertory of Patent Inventions, May, 1850.

† From the London Journal of Arts and Sciences, September, 1850.

In practice, it is found that, by the employment of the mixture described, 60 per cent. of acid is saved, and not one-half as much metal lost as in the old process. The new method is also peculiarly applicable to the cleansing of works in zinc and brass. It may be remarked, in passing, that, if the mixture of water, acid, and organic matter be employed as the exciting fluid in a cell of Bunsen's galvanic battery, the consumption of the zinc will be diminished to one-eighth the ordinary quantity, without in anywise enfeebling the energy of the electric current.

The substances mentioned above as being employed, in addition to the acid liquor, in the experiments of MM. Thomas and Delisse, being somewhat difficult to procure under some circumstances, particularly by persons engaged in ordinary industrial occupations, M. Elsner entered upon a series of trials, in order to ascertain whether or not certain organic matters, of a cheaper class, and more easily procurable, could not be substituted for those already tried with so much success. With this object, both wood and coal-tar were mixed with the dilute acid. As these substances contain creosote, and other products of the destructive distillation of organic bodies, the useful effect of which had been proved by the previous experimenters, it was believed that they would advantageously replace the rarer and more expensive materials first tried. The mixture of tar and dilute acid was, in fact, found to answer perfectly well the objects of the experiment: a piece of casting, in iron, was immersed in the mixture;—the metal was completely cleansed of the coating of oxide without any disengagement of hydrogen gas; and the surface was of a clear greyish-black color, quite clean, and smooth, and totally unattacked by the acid. A similar piece of casting, immersed in the kind of acid solution ordinarily used in this process, was almost wholly dissolved in an equal time.

The practical value of this process seems to be so considerable as to render it worthy of being generally known and tested by more extended trials.—*Technologiste.*

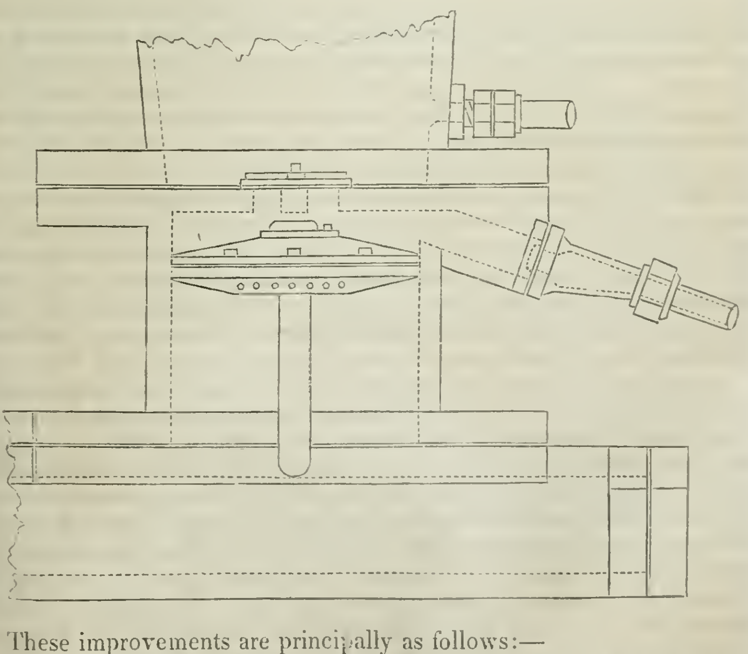
FRANKLIN INSTITUTE.

Committee on Science and the Arts.

Report on H. P. M. Birkinbine's Hydraulic Rams.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, to whom were referred for examination—"Improvements in the Hydraulic Ram," by Mr. H. P. M. Birkinbine, of Philadelphia, Pennsylvania,—Report:—

That the committee for a long time hoped that it would have it in its power to take advantage of this opportunity to examine into and report upon the general question of the advantages of the Hydraulic Ram, as an instrument for raising water, and to investigate the theory of this machine, with its new improvements, as had been so admirably done by Eytelwein for its old forms. The committee however regrets, that the other necessary occupations of its members, prevented them from devoting that attention to the subject, which would be necessary, in the extended and laborious series of experiments which would be required to elucidate the matter. They, therefore, reluctantly confine themselves to a simple report on the value of the improvements which Mr. Birkinbine has introduced into the instrument, and the degree of perfection, which by these improvements, and by accurate workmanship, and well studied proportion of the parts, he has given to it.



These improvements are principally as follows:—

First: constructing the discharge valve (*stop valve, soupape d'arret* of Eytelwein) of the ram, so that as it rises into its seat, a portion of water is caught between the valve and seat, and thus a water-cushion formed, which prevents the heavy blow, and the consequent rapid destruction of the apparatus. The manner in which this is accomplished, is very evident, from the accompanying figure, in which it is seen that the valve is made with a small recess around its upper margin, while the seat into which it rises, has a corresponding flange, and the upper edges being so proportioned that that of the valve slides past the flange, before the valve has reached its seat, a portion of water is caught in the recess between the valve and seat, and forms the cushion.

The second improvement consists in so forming the parts, as to place the cup or air chamber, which in all these machines is placed at the discharging orifice to arrest gradually the impact of the water there, upon the valve itself, and not upon the valve seat; by this means, it is believed that the shock upon the valve is materially lessened, and the valve kept longer in use.

The third improvement consists in adjusting the drop-cup, into which the guide-stem of the valve falls, by means of a wedge, controlled by an adjusting screw, so that the amount of the fall of the valve may be accurately set, and altered when a change of circumstances require it. By means of this arrangement, the quantity of water discharged by the valve can be reduced or increased at pleasure, within considerable limits.

Another improvement consists in laying down the driving-pipe, or that which conveys the water from the fountain-head to the ram, in the form of a cycloidal curve, which, as is well known, is the curve along which a body descends from one given point to another in the shortest time, and therefore, with the greatest mean velocity. By this means the momentum of the descending column, upon which depends the effect of the ram, is increased. The credit of the calculation of this curve is due to Mr. Joseph Strode, of West Chester, an ingenious mechanic and competent mathematician, who has, as it appears, been very successful in his introduction of this ram in the vicinity of that place.

Another improvement, which the rams of Mr. Birkinbine have, in common with those of several other patterns now constructed, is an arrangement of inclined water ways, by which the valve is made to rotate slowly, while it rises and falls, thus preventing it from striking twice successively in the same place, and thus avoiding irregular wear. This is evidently an improvement of some importance, the origin of which is, however, not claimed by Mr. B.

In addition to these improvements in the ordinary ram, Mr. Birkinbine has introduced an improvement into the double-acting or piston ram, first suggested by Montgolfier, the inventor of the machine, and very useful in certain cases, since it allows the whole quantity of water from a feeble spring of soft or mineral water, to be raised by the power of a heavier stream of water, not itself fitted for the uses for which the water is wanted. The arrangement of Montgolfier consisted in elevating the air vessel of the ram upon a chamber, into which a solid piston was introduced. Into this chamber, above the piston, but below the valve leading to the air vessel, is the entrance pipe of the water to be raised. The stream of working water passes through the body of the ram below the piston, and by its inertia, when the discharge valve closes, forces up the piston, by which the water lying upon it is driven into the air vessel. This arrangement has been, however, found of little or no use, in practice, in consequence of the accumulation of air under the piston, which then ceases to work. This is remedied in Mr. B.'s construction, by a small air valve in the piston, by which this accumulation is prevented. It is true that by this means, a very small quantity of the lower water is permitted to pass into that above the piston, but this will not take place to any hurtful extent.

This enumeration, it is believed, contains the principal modifications which characterize the rams constructed by Mr. Birkinbine. The committee would have been very glad to have studied them separately, in order to appreciate their several effects, but the causes above enumerated have obliged them to abandon this attempt, and content themselves with the examination of the instrument when complete. Mr. Birkinbine has stated to the committee, that he has up to this time constructed and put in use about 1000 of these rams, and that they have very generally been found to give entire satisfaction to their owners.

The largest of these are worked by driving pipes of 6 inches diameter. Such is the ram constructed for the town of Naples, in New York, intended to supply the town with water. The fall is 6 feet, and the water is lifted 60 feet high. It is calculated to raise, when in full action, 20,000 galls. per day. A ram of the same size is erected at Hazleton, on the Lehigh. The fall here is 8 feet, and the rise 117 feet. The delivery pipe is 2300 feet long and 1½ inches in diameter. A ram of the same size has been sent to Cuba, but not heard from.

A ram of 5 inches diameter of driving pipe is erected upon the Mine Hill and Schuylkill Haven Railroad, with a fall of 4 feet, and a rise of 40 feet, through a 2½ inch pipe.

The committee have not been able to get the data for calculating the practical coefficient of these rams, but they had that opportunity with one which was erected for the purpose of supplying the Girard College with water, which had a driving pipe of 2½ inches diameter, and 160 feet in length—the fall 14 feet. The delivery pipe was 2260 feet long, 1 inch in diameter, and the height to which the water was raised 93 feet. The coefficient determined by the committee was 71 per cent., which when we consider the great friction met with in forcing water through so long and narrow a pipe, which being of lead, could not be laid entirely straight, must be considered as fully establishing the high practical effect of these instruments.

The committee tried a number of experiments upon several rams at the shop of the maker, in which they also frequently got high results, but as these experiments were not for the purpose of determining the coefficient but for the purpose of studying the effects of various changes, such as the weight and length of fall of the valve, the length and diameter of the driving and delivery pipes, the number of strokes per minute, &c., and as they are incomplete, they do not think it worth while here to record them. In conclusion, however, they have no hesitation in expressing their opinion, that the Hydraulic Rams, constructed by Mr. Birkinbine, are very efficient instruments for raising water, and peculiarly valuable in many circumstances to our agriculturists; and that the modifications in their arrangement, which constitute their peculiarity, are valuable improvements, inasmuch as they permit the instruments to be made of larger size, and render them more lasting, and less apt to get out of order.

By order of the Committee.

William Hamilton, *Actuary.*

Philadelphia, May 9, 1850.

Committee on Exhibitions.

Address Delivered by Hon. Wm. M. Meredith, *at the close of the 20th Exhibition of American Manufactures, held by the Franklin Institute, October*, 1850.

Many societies have been formed for the promotion of science and the arts, but of them all the Franklin Institute is probably the most useful because the most practical. Its activity is not confined to an annual exhibition. Its functions are always in active exercise, and its beneficial effects are felt through the whole circle of mechanic arts. Its premiums are awarded with an impartiality and judgment which are recognised by the whole community, and hence the ingenious mechanic who has obtained one of these honorable distinctions, has obtained with it a just reputation in his art and a sure hold upon a good and profitable custom. This institution has imitators and emulators elsewhere; but we are proud to believe that in none of them do the members combine to a greater extent the highest degree of science with the most practical knowledge of and experience in mechanical details.

The active organization of the Franklin Institute is threefold, and consists of the Society at large, the Board of Managers, and the Committee on Science and the Arts.

Each of these bodies has its distinct and separate duties, powers and functions, which are executed, in a great measure, independently of the others.

The operations of the Society, which are carried on by means of annual and monthly meetings, and through the agency of various committees, embrace most of the public transactions of the Institute, and the custody and arrangement of its peculiar property, such as the Hall, the Library, and the Cabinets of models and minerals; and at the meetings of the Society, are held the discussions on matters of general interest.

The Society now numbers over 2000 members. The Library contains more than 5000 volumes. The Cabinets contain some 350 models, and between 7000 and 8000 specimens of minerals.

The Board of Managers is elected by the Society at its annual meeting, and has the custody and control of the funds of the Institute, and the direction of the Schools, the Lectures, Exhibition, and the Journal.

The receipts from these sources, together with the contributions from members, constitute the revenue of the Institute.

The Committee on Science and the Arts is composed of those members of the Society who voluntarily enroll themselves as members of that Committee, and agree to perform the duties required of them. These duties embrace the investigation of scientific and mechanical problems of general interest, and investigations of questions submitted for their decisions, by individuals or corporations, municipal or others, or by the State or Federal Government.

Since its origin this Committee has raised more than 500 sub-Committees, charged with different investigations, or with the examination of inventions, the authors of which desired either a written report or private advice.

The labors of the members of this Committee have been bestowed upon many subjects of public interest, among which have been, an elaborate investigation of the causes of the explosion of steam boilers, undertaken with the approval of the government of the United States.

An examination and report upon a system of weights and measures, made at the instance of the State of Pennsylvania.

An extensive series of experiments upon different forms of water wheels.

A report to the Councils of the City of Philadelphia on the best methods of paving the streets of the City. An examination at the instance of the same bodies, upon the best form of lamp for street lighting.

A scheme for the prevention of steam boiler explosions, by legislative enactments. And repeated experiments upon the friction of heavy masses in motion—such as vessels at launching. The two latter subjects are in charge of standing sub-committees.

There is one subject, intimately connected with the welfare of the mechanic arts, to which the attention of the parties interested cannot be too often invited; I mean, the defects in the existing Patent Laws.

These laws as they at present exist, I fear it must be acknowledged, do not "promote the progress of Science and the useful Arts," but rather impede and embarrass their progress:—they do not "secure to inventors the enjoyment for a limited time, of the exclusive use of their discoveries,"—on the contrary, they make the ultimate discovery of almost every inventor the same, viz., that whatever may be his fame in the next generation, his fate in the present is unceasing, and ruinous litigation—while the mere pretender is sometimes enabled to vex the community for a series of years by extortions, under color of supposed or frivolous inventions.

This subject should be presented and re-presented at every opportunity, with such suggestions as may occur, until some adequate remedy shall have been applied; and I think there should be in every mechanical institution, a standing Committee on the Patent Laws.

The principal ends of Patent Laws are, or ought to be,

1. To secure the granting of patents for useful inventions, and for none others.

2. To prevent the violations of patents so granted.

3. To secure to the public the use of patented inventions on reasonable terms, and to patentees a reasonable reward for their ingenuity.

1. For the present insufficient mode of examining the question of originality before the issue of a patent, I would substitute something like the following:—Public notice to be given of the application for a patent, accompanied by a copy of the specification filed, and calling on all persons who may object to the application, to present to the Commissioner

of patents in writing the grounds of their objection within a limited period, say 12 months. At the expiration of that period, the examination should take place, by a board of competent examiners. If necessary, they should have authority to cause depositions to be taken with notice to the applicant; and he should in like manner be allowed to take depositions on his behalf: and any parties should be heard, who should desire to oppose the application. If the result should be a grant of the Patent, the patent so granted should be conclusive evidence of its own validity, and the only question to be thereafter tried, should be the question of infringement in fact. During the period between the application and the final decision and issue of the patent, the applicant should be at liberty to introduce his invention to public use, without waiving his right: and any person using it during that interval without the consent of the applicant, should (if the Patent were afterwards granted) be liable for the infringement in the same mode as for a similar use after the issue of the patent.

2. In lieu of the existing system of injunctions in Chancery, and actions for damages, I would impose as a penalty for infringement, a sum equal to ten times the sum to be paid for the liberty to use the patent: one-half of this penalty should go to the United States for the use of the patentee, and the other half to the party who should sue for the same or who should inform the patentee of the existence of the infringement. On payment of the penalty, the defendant should have a license to use the patent to the extent of the use for which the penalty had been imposed: but on judgment for the penalty, he should, as a matter of course, be (at the option of the patentee,) enjoined by a writ issued in the case itself, and founded on the judgment, and to be enforced by the usual attachments, &c., from using the patent until payment of the penalty, or new penalties should be recoverable for the subsequent use.

In actions for the penalties, it should be lawful for the Court on the application of either party to award a special venire facias, commanding the Marshal to return on the panel, a certain proportion at least, of persons of competent science and skill in the particular art to which the patent relates, and at least four of the skilled persons so returned, should sit as jurors in the trial.

3. At the time of reporting in favor of the issue of the patent, the examiners should also report a certain fixed sum to be paid to the patentee for the license to make, vend, or use the thing patented—if a machine: so much for each machine, to be so made, vended, or used:—if a process of manufacture: so much for any given quantity made by the process. The sum thus fixed, should be advertised with notice of the issuing of the patent: and any person paying that sum into the Patent Office for the use of the patentee, should receive a certificate which should be a license to the extent of the sum paid: and all persons engaged in making and vending the thing patented, or in manufacturing by a patented process, should be required from time to time, to report on oath, the extent of use by him, and deposit the sum due thereupon.

An account should be kept at the Patent Office of all sums so received for the use of the patentee, who should be entitled to receive the same at certain fixed intervals—say, quarterly, semi-annually, or annually, as might be thought most convenient, after deducting a per centage, say five per cent. allowed to the Patent Office for defraying the expenses of collecting and keeping the account.

Proper provisions should be made for appeals by the applicant, or those opposing his application, from the decision of the first Board of Examiners, on the question of issuing the patent and on the sum to be paid for license to use it.

It appears to me that some such system as I have here roughly sketched, would, if properly digested, and carried out, relieve most of the existing embarrassments.

BIBLIOGRAPHICAL NOTICES.

"*The Gallery of Illustrious Americans.*" *Containing the Portraits and Biographical Sketches of* 24 *of the most eminent citizens of the Republic, since the death of Washington. New York: Brady, D'Avignon & Co., G. D. Putnam, D. Appleton & Co., C. S. Francis & Co.* 1850.

The work consists of a series of portraits, with biographical notices appended, intended to make us familiar with our own great men. The present number contains the portrait of Col. Fremont; how he gets there we cannot say, but will not at present stop to question his right. The portrait has the appearance of faithfulness, and is well lithographed and printed; but we are sorry that some friend with better taste had not been at the editor's elbow to induce him to adopt a more legible form of type. The execution is very good, but the form is exceedingly unreasonable and unpleasant. Ed.

Elements of Natural Philosophy. By W. H. C. Bartlett, LL. D., *Prof. Nat. & Exper. Philos. in the U. S. Military Academy at West Point. Sec. I.—Mechanics. New York: A. S. Barnes & Co.; Cincinnati: H. W. Derby & Co.* 1850.

In the last number of the Journal we acknowledged the receipt of a copy of the above work, and noticed favorably the mechanical execution of it, promising to take another opportunity, after a more careful examination of it, to express our opinion upon its scientific merits. We now return to the subject for the purpose of recommending its perusal to every one whose taste or interest leads him to desire a clear and accurate knowledge of the principles of which the work treats. The amount of valuable time and labor which are every year thrown away by ingenious men, by inventing useless and impossible apparatus, would scarcely be credited by any one whose business does not require him to examine the list of patented inventions, or to come into contact with inventors themselves. Even the perpetual motion, which has for so many centuries been the stumbling block of half educated men, is not yet done with, and the unfortunate man to whom such an invention is submitted, finds it impossible to convince its well meaning author of the futility of his scheme, because he has misunderstood some one of those axioms of mechanics which have been traditionally handed down in the language of past centuries, and which have now either no meaning at all, or one entirely at variance with that which they appear to have. We hope that the treatise before us will do much, if carefully studied, to relieve this difficulty, and to save time and money to our inventors. The work is very elaborately written, the fundamental principles carefully laid down, and fully illustrated, and the deductions from them cautiously and clearly drawn. As an illustration of this, we would refer particularly to the treatise upon the living force and quantity of work of moving bodies, terms which are very loosely used by our mechanical writers, and scarcely ever clearly comprehended by their readers. The explanations of Professor Bartlett render his use of terms precise, and the distinction between the quantities designated easily understood. Great care is also evinced in the treatise on the mechanics of fluids, a subject so incomprehensible to the most of our inventors of water viators. The treatise is not, however, uniformly so happy; occasionally the Professor appears to have slumbered, as in the attempt to illustrate elasticity, (p. 18.) But we hope that the demand for the work will soon require a new edition, in which a careful revision will remove these comparatively few defects. Ed.

Dr. Gorrie's Process for the Artificial Production of Ice.

A pamphlet with the above title has been laid upon our table. The plan proposed by Dr. G. is the condensation of air by a force pump, the absorption by water of the heat thus developed, and the subsequent absorption of heat from another portion of water by the sudden expansion of the air thus condensed and cooled. The outlines of the plan are not new, having been often before proposed, and dating from at least as far back as Oliver Evans, who proposed to erect a steam engine for this very purpose; but so far as our knowledge goes, Dr. Gorrie is the first man who has devoted himself practically to the experiment upon such a scale as to ascertain and avoid the practical difficulties. The description of his apparatus in the pamphlet is not of a nature to allow us to judge fully how far he may have succeeded; but the experiments published by him in the Journal of Science and Arts, (Silliman's,) although good for nothing for the purpose for which he proposes them, that is, for the scientific determination of the absolute heat set free in condensing air, appear to be amply sufficient to justify his anticipations of the practical success of his apparatus. If, as Dr. G. states, a machine properly planned and executed, "would not require, at a mean atmospheric temperature of 70° F. more than half a horse power; at 85° F. more than a horse power; and at 90° F. more than one and a half horse power to produce a ton of ice in twenty-four hours; and on a large scale, as one for producing ten tons and upwards per day, the proportional consumption of power would certainly be much less"—his success is certain, and he deserves as certainly the credit of the practical invention.

We do not think the wordy and extravagant praise of the newspaper articles, of which the pamphlet is made up, likely to do Dr. G.'s project any good, but we hope that it may do him no harm, for his success, although not likely to improve the moral and intellectual faculties of our Southern brethren, will be a great good to society throughout the whole torrid and temperate climes. Ed.

JOURNAL

OF

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OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

DECEMBER, 1850.

CIVIL ENGINEERING.

Report of the Commissioners Appointed to Inquire into the Application of Iron to Railway Structures.[*]

Iron roads traverse the land in its length and breadth; binding with their chains the remotest districts of the island, and giving to the inhabitants of Great Britain more completely the character of a united family than they have ever before enjoyed. With the increasing commercial prosperity of our country grew the desire to obtain the means of more rapid communication. Maritime Liverpool pined to draw nearer to manufacturing Manchester, and metropolitan London panted to reach more quickly the metal mart of Birmingham. Of this gradually intensifying desire the locomotive use of steam, with all its incidents, was more than the fulfilment. Hills were broken down, and their debris employed to fill up the valleys,—mountains were bored and rivers spanned,—to make the commercial dream a reality. In carrying out these gigantic tasks, the ordinary materials failing to answer the purpose demanded,—some new one was to be sought: and wood and stone being abandoned, our highways were paved with iron. The iron rail on which the steam-giant toils, with its enormous train, viaducts and bridges, suspended roadways and perforated tunnels, are all constructed from this most important metal.

Though iron has its place in technical history from a very early period, and although man has shaped it into a thousand forms, yet under the new conditions to which it is now so extensively submitted it was soon discovered that we were ignorant of its physical conditions, and particularly of its molecular changes. The importance of obtaining this knowledge was pressed on us by more than one painful accident arising from the breaking of cast-iron girders, though they had been previously tested, and proved to be of sufficient strength to support considerably more weight than was to be placed on them. As these accidents had arisen in mills where the iron beams were subjected to the influence of long-continued tremor promoted by the machinery, or on bridges which were submitted to the rapid passage of heavily-laden trains, it was thought that some important molecular change must have taken place in the structure of the iron. This impression received support from the evidence of many experiments. Iron bars were selected which when broken presented a fibrous structure, and these were subjected to long-continued vibratory action; after which on being broken they often showed a crystalline fracture. These experiments have been deemed by many to be fallacious; and we find Mr. Brunel stating that "the same piece of iron may be made to exhibit a fibrous fracture when broken by a slow heavy blow, and a crystalline fracture when broken by a sharp short blow." We are, however, assured by many of our most experienced machinists that iron does undergo a molecular change when subjected to long-continued agitation, and that this injurious change can be always repaired by careful annealing. When we have indisputable evidence of long-continued molecular disturbances under the influences of heat and electro-magnstism, we are disposed to believe in the theory that structural derangement may be produced by merely mechanical causes. It was, therefore, to investigate the subject of the application of iron to railway structures that a Commission was appointed, consisting of Lord Wrottesley, Profs. Willis and Hodgkinson, Capt. James, and Messrs. George Rennie and William Cubitt, with Lieut. Galton as secretary: and well do these Commissioners appear to have performed the duty committed to their charge.

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[*] From the London Athenæum, September, 1850.

At starting, the Commission endeavored to make themselves acquainted with all the experiments which had been already made on iron by engineers; and on this point they state:—

"From the information supplied to us, it appears that the proportions and forms at present employed for iron structures have been generally derived from numerous and careful experiments, made by subjecting bars of wrought or cast iron of different forms to the action of weights, and thence determining by theory and calculation such principles and rules as would enable these results to be extended and applied to such larger structures and loads as are required in practice. But the experiments were made by dead pressure, and only apply, therefore, to the action of weights at rest. As it soon appeared, in the course of our inquiry, that the effects of heavy bodies moving with great velocity upon structures had never been made the subject of direct scientific investigation, and as it also appeared that in the opinion of practical and scientific engineers such an inquiry was highly desirable, our attention was early directed to the devising of experiments for the purpose of elucidating this matter."

As all railway structures are necessarily exposed to "concussions, vibrations, torsions, and momentary pressures of enormous magnitude produced by the rapid and repeated passage of heavy trains," it became a question of the extremest importance to ascertain if any, and what amount of change was produced in iron under these influences. It must be remembered that although the injurious action may be in each case exceedingly small, and unworthy of particular notice, it is, from the nature of the material, probable that such derangement has a certain degree of permanence, and that by multiplying the causes a dangerous, and perhaps fatal, result may ensue. We should not be satisfied that the iron bridges spanning our numerous rivers, roads, and valleys; or the tubes which cross the Menai Straits and continue the Holyhead line at Conway, are secure for a few years to come. We should determine the amount of injury, if any, which is produced by the passage of every train, and so secure these structures that they may be maintained in perfect safety, with ordinary attention, for any period of time. To ascertain the effects of moving weights, a well devised apparatus was constructed in Portsmouth Dockyard, and a very extensive series of experiments made by Capt. James and Lieut. Galton. "The results which they obtained were equally new and important, developing for the first time the fact that *a given weight passing rapidly along a bar produces a greater deflexion in that bar during its passage than it would have done had it been suspended at rest from the centre of the bar.*" That is to say, a much less load will break an iron bar when moving rapidly along it, than will fracture it in a state of rest. In the report we are informed:—

"Thus, for example, when the carriage loaded to 1120 pounds was placed at rest upon a pair of cast iron bars, 9 feet long, 4 inches broad, and 1½ inch deep, it produced a deflexion of six-tenths of an inch; but when the carriage was caused to pass over the bars at the rate of ten miles an hour, the deflexion was increased to eight-tenths, and went on increasing as the velocity was increased, so that at thirty miles per hour the deflexion became 1½ inch; that is, more than double the statical deflexion. Since the velocity so greatly increases the effect of a given load in deflecting the bars, it follows that a much less load will break the bar when it passes over it than when it is placed at rest upon it; and accordingly, in the example above selected, a weight of 4150 pounds is required to break the bars if applied at rest upon the centres, but a weight of 1778 pounds is sufficient to produce fracture if passed over them at the rate of thirty miles an hour."

The Commissioners properly insist, therefore, on the importance of giving to all railway structures an amount of solidity far superior to that which is found by experiment or calculation sufficient to support as a dead weight the heaviest loads that can ever travel over them.

A most important series of experiments by Mr. Eaton Hodgkinson on the tensile and crushing strengths of iron under a great variety of forms and conditions, which form Appendix A to this Report, must prove of the utmost value to engineers; so will the mathematical investigation of the subject by Prof. Willis and Mr. Stokes.

It is shown by some carefully conducted experiments made by Capt. James that the strength of iron bars is not increased with their diameters; owing to the circumstance of their assuming a crystalline structure in the middle during the process of cooling, which goes on, of course, more slowly there than on the outside of the bar. This has been frequently observed in large iron castings; but we are not aware of any published set of experiments which so satisfactorily show the great importance of annealing all iron girders, and of limiting the thickness of each mass of iron employed for supporting heavy, and particularly moving, weights, as Capt. James's. This thick Blue-book and its accompanying volume of plates, we must regard as a valuable contribution to scientific engineering. It is, however, to be regetted that the experiments of the Commission did not embrace the effect of wrought iron tension bars on cast iron girders as applicable to such structures as the Dee and numerous other bridges of a similar construction. By some this form has been absolutely condemned as insecure; while other engineers still contend that it may be employed with safety.

We understand that the labors of this important Commission were prematurely stopped by cutting off the necessary funds for carrying on the experiments. Surely, seeing the important uses to which, on land and sea, iron is now employed, it was not a wise economy to put an end to an inquiry which promised to be of such great national importance.

Description of the Insistent Pontoon Bridge, at the Dublin Terminus of the Midland Great Western Railway of Ireland. By Mr. R. Mallet, M. Inst. C.E.*

This bridge was stated to be situated on the line of approach from the city to the terminus, and formed a passage over one branch of the Royal Canal, where it crossed the Phibsborough road, upon the Foster Aqueduct. By the act it was provided that the navigation of the canal should be as free and unimpeded as possible; and from the circumstance of there being only a height of 16 inches between the intended surface of the road and that of the water of the canal, it necessarily involved the placing of some kind of movable bridge, of rather peculiar construction. After due consideration, the one described in the paper was designed and adopted, as being more suitable to the peculiarities of the situation than any other, owing to the water channel being only 17 feet 4 inches in width, and that the passage to be made across it required to be at least 50 feet in breadth.

The general idea of this form of movable bridge was that of a pontoon, or flat-bottomed boat, constructed of iron; the breadth being nearly equal to that of the water space to be crossed, and the length about equal to the width of roadway required. The deck beams of this pontoon projected over the sides, and rested while *in situ*, upon a rabbate, or continuous recess, formed along the top course of each quay-wall, but while the pontoon was floating light, the projecting deck-beams were 2 inches clear of this rabbate, and the roadway platform, constituting the deck of the pontoon, was elevated to an equal height above the level of the top of the quay-walls, or land on each side; in this state the pontoon could be freely and readily pushed along the canal, for a distance of rather more than its own length, until it was brought opposite to a lye-by, provided by increasing the width of the canal at this point, and being put therein, the navigation was perfectly free.

* From the London Architect, April 25, 1850.

As a pontoon afloat would form a very unstable roadway for carriages, means were provided for allowing it to settle down in the water, and rest firmly upon the rabbates: and also for again raising it rapidly, so as to float clear of the rabbates, and enable it to be moved away into the lye-by. For this purpose two large valves were placed in the bottom of the pontoon, one near each end, by which water was allowed to enter, and sink the pontoon, until it hung upon the projecting deck-beams. For removing this water, when it was required to float the pontoon, a large syphon, of a particular construction, was provided, which was capable of being brought instantly into use, and of being as quickly detached, when a sufficiency of water had been withdrawn to enable the pontoon to be moved. These operations were stated to be performed very readily by one man, the navigation being cleared in four minutes, and the roadway restored in less than three minutes.

The details of the construction of the pontoon, of the syphon, and all other parts of the work, were then minutely given; also, the total cost of the structure, which, exclusive of the masonry, was 1125*l.*, that of the masonry being about 150*l.*; and it was stated to have continued in use, with perfect satisfaction, since its completion in February, 1847.

This form of construction was considered to be applicable in situations where a comparatively narrow water channel had to be crossed by a very wide roadway; but as the particular circumstance of other localities might differ from the one in question, the author suggested various alterations in the details, so as to meet these exigencies.—*Proc. Ins. Civ. Eng.*

Description of the Ballochmyle Viaduct over the River Ayr, on the line of the Glasgow and South-Western Railway. By WILLIAM M'CANDLISH, Esq., *Resident Engineer.**

This viaduct, it was stated, carries the Cumnock Extension of the Ayrshire Railway (which, on amalgamation, becomes part of the Glasgow and South-Western Railway,) over the river Ayr, about a mile from the village of Mauchline. In order to attain the summit of the country near Cumnoch, the line required to cross this river at an elevation of 178 feet above its bed. The river is about 100 feet wide, and runs between high rocky banks, which are used as abutments from which to [spring the great arch. The viaduct consists of seven arches, the centre one being 180 feet in span, and the three on either side of it being 50 feet in span each, and all semicircular in form. The arch stones of the great arch are, on the outside, 5½ feet deep at the springing, and 4½ feet at the crown, but inside they were about a foot deeper. To give an idea of the magnitude of the viaduct, let it be compared with the Dean Bridge, near Edinburgh. If placed with the river bed on the same level as that of the Ayr, the roadway would stand 65 feet below that of the Ballochmyle bridge, and the great arch of the latter would span two arches of the former. Again, if Lord Melville's monument in St. Andrew's square were placed beneath the great arch, the head of the statue would not reach the crown of the arch. The stone of which the bridge is built is a close grained red freestone, and was obtained from quarries opened on either side of the river, being conveyed to the bridge along service railways, which conducted to a gangway erected across the valley in connexion with the centering. From this gangway they were removed to their positions by means of traveling cranes, stretching across the whole building. The centering was erected in four stages, each stage being proceeded with as the building advanced, and consisted of whole logs of memel, placed one above another, and properly connected, at each stage, with cross ties and diagonal braces, and well secured by bolts, &c. The quantity of timber used was about 50,000 cubic feet, and of iron about six tons. The work was commenced in November, 1845, the great arch was keyed on 8th April, 1847, and the last stone was laid on 14th March, 1849; the building being completed within three years and four months from its commencement. The number of men employed averaged about 400; and, to the credit of Messrs. Ross and Mitchell, the contractors, and Mr. Fulton, their superintendent, not a single serious accident occurred during the execution of the work. During its progress, it was visited by vast numbers of people from all parts of the country, attracted by the beauty of the scenery and the grounds, as well as by the interest attached to the operations which were going forward. The quantity of stone used in the viaduct was about 530,000 cubic feet, and the total cost of the work was about £41,000.—*Proc. Roy. Scot. Soc. Arts.*

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* From the Glasgow Practical Journal, August, 1850.

AMERICAN PATENTS.

List of American Patents which issued from October 15*th to November* 5*th*, (*inclusive*,) 1850, *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

OCTOBER.

40. For an *Improvement in Braces for Carriage Tops;* John L. Allen, New Haven, Connecticut, October 15.

Claim.—"What I claim as my invention, is the construction and arrangement of braces for carriage tops, so that when one limb or part of the brace is turned upon a prop, fulcrum or pivot, all the joints of such brace are simultaneously moved, or operated substantially, as shown in the drawings.

"I also claim the adaptation of a graduating strap, loop, or similar device, so as to secure the top at any desired elevation, as herein set forth."

41. For *Improvements in Filtering Cocks;* Daniel Bartlett, Jr., Boston, Massachusetts, October 15, 1850.

Claim.—"What I claim as my invention, is the combination of parts arranged, constructed, and made to operate together substantially in the manner hereinbefore set forth; the said combination consisting of the box or case, the tubular passage way, having three discharging orifices, the turning or hollow plug, made with a discharging orifice, the central and two lateral chambers, the passages connecting the openings with the chamber, the self-operating valves, and their stem and seats, and valve openings, the passages leading out of the bottom of the two lateral chambers, the central discharge pipe leading out of the chambers, the partitions, and the filtering medium, having wire gauze chambers as above specified, or being used without them, as occasion may require."

42. For an *Improvement in Looms;* Amos H. Boyd, Saco, York County, Maine, October 15.

Claim.—"I lay no claim to spring motions, as they have been usually constructed and made to operate, but what I do claim as my invention, is the combination of the vibrating posts and springs applied to them, as arranged and adapted to the loom frame, and the operative parts with which they are connected, substantially in the manner and for the purpose of easing the web, without varying its horizontal position as hereinbefore specified."

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43. For an *Improvement in Machines for Pulverizing Sugar;* Oliver R. Chase, Boston, Suffolk County, Massachusetts, assignor to Silas E. Chase, Charlestown, Massachusetts, and Oliver R. Chase, Boston, Massachusetts, October 15.

"The external or first part of my invention consists of a cylindrical vessel or mortar, made of cast iron or other suitable material, and of such thickness and dimensions as circumstances may require."

Claim.—"What I claim as my invention, is the combination of a rotative series of cells, a rotative series of stampers, suitable machinery for actuating the stampers, and a cylindrical mortar, when arranged and made to operate together, and to receive, pulverize, and expel sugar, or other material, substantially in the manner as hereinbefore specified."

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44. For an *Improvement in Hemp Harvesters;* William Baily Coates, Big Lick, Virginia, October 15.

"Having described the drawings, and referred to the parts by letters, I shall proceed to state the particular nature of my invention. This consists in placing choppers, with their edges so as to strike obliquely, on a rock shaft—that by a lateral and semi-rotary motion combined, they may cut an oblique stroke against the top and right edges of the teeth. In obtaining this motion I employ a male and female screw as before described. Also in placing a light frame with a spring bottom to catch the hemp when it falls back. This frame can be made with the rods closer to the back long transverse piece of frame, and placing the long pieces closer together, it would then catch rye, wheat, &c."

Claim.—"What I claim as my invention, is:

"1st. The box on the right marked Q, which is a constant oil retainer.

"2d. The combined sides, and spring bottom for catching and laying the hemp, &c.

"3d. I claim casting (or securing in any firm manner) choppers on a rock shaft, with the edges chisel shaped, and set so as to strike obliquely against the top and right edges of the teeth, when the part moves by a lateral and semi-rotary motion. In procuring this combined motion, I employ a male and female screw thread as already fully described in the preceding part of these papers. I do not desire to be understood as confining myself to the screw in getting this motion in N, but will employ any other method most suitable to produce the desired result, and which shall be substantially the same."

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45. For an *Improvement in Grain Cradles;* Isaac T. Grant and Daniel H. Viall, Schaghticoke, Rensselaer county, New York, October 15.

Claim.—"What we claim as our invention, is the particular construction and arrangement of the brace rods C, so as to fold down upon the fingers, as shown in Fig. 2, each being bent in the proportionate angle fitting their respective localities, the ends thus bent pass through the fingers perpendicularly at *d*, and are secured by riveting the same upon the upper side of the fingers, which shape and form given to the wire braces, forms and constructs a hinge joint, and each may be turned or swayed in the direction desired, and when separated from the sneath, each wire brace is placed in the position as is represented by Figure 2, aforesaid, permitting large numbers to be packed in a condensed form, in packages or boxes convenient and proper for removal, storage, or transportation, substantially the same as herein set forth and described."

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46. *For* an *Improvement in Pegging Jacks;* Jacob Jenkins, Andover, Essex county, Massachusetts, October 15.

Claim.—"What I claim as my invention, is the combination of the two jaw blocks, and the double spring connecting rod, as constructed and made to operate together, and in connexion with the other parts of the apparatus substantially as herein above specified."

47. For an *Improvement in Machines for Folding Paper;* George K. Snow, Boston, Massachusetts, October 15.

Claim.—"My invention consists principally in a combination of machinery or parts, in which the sheet is *not seized, completely folded, and delivered,* by converging and moving surfaces, such as two series of endless tapes and rollers: I make use of no such contrivances, and their operative machinery, in combination with a *mere bar* or contrivance for acting against the middle of the sheet, and pressing such middle part between such converging surfaces which *seize the sheet, draw it away* from the said bar or contrivance, *complete the fold,* and deliver the paper."

Claim.—"My improvement or combination, as invented and claimed by me, consists of the following elements: 1st, a slotted plate, table, or contrivance, for receiving and supporting the sheet. 2d, Two parallel planes or plates, extending at right angles from such support, and so arranged, that there shall be one of the said plates on each side of the slot, of the first element or support of the sheet. 3d, A striking and folding frame or plate, so arranged and operated as to press the paper against the middle or other proper part of it, force it downwards through the slot, and between the two parallel plates; the said parallel plates operating to complete the fold, and to hold the sheet of paper during the return or retrograde movement of the sliding frame or plate. And in combination therewith I claim a second striking and folding plate arranged at right angles to the said two parallel plates, and made so to pass or operate through them or their slots, and directly after the said retrograde movement of the first one, as to press against the sheet of paper, and force it through one of the said slots, and thereby once more or a second time fold it.

"And I claim in combination with such second combination of mechanism, a third striking and folding plate, and slotted parallel folding plate, and friction rollers, or equivalent contrivances, the same being for supporting the twice folded sheet of paper, folding it a third time, and subsequently discharging it, such discharge taking place in consequence of the return or retrograde movement of the striking or doubling plate as above described.

"And I also claim the combination of mechanism which is applied to the striking plate and its rollers, or folding contrivances, and used for packing the sheets; the said mechanism consisting of the stationary plate, and the spring plate, or plate and its springs, or other proper equivalents, which permit the recession of the plate in proportion as the pack of sheets increases in size; the whole being arranged and made to operate, substantially in the manner as herein before specified."

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48. For an *Improved Machine for Excavating and Conveying Earth;* John A. Sprague, Dayton, Montgomery county, Ohio, October 15.

"The machine consists of wheels, axles, tongue, and forward bolster, of a common two horse wagon, the fore and hind axles of which are coupled together by a frame, upon which, near the fore end is a windlass, consisting of a lower cross timber, and two upright timbers, and an upper cross timber, and an iron shaft, and a rag wheel, and a crank."

Claim.—"What I claim, is the combination of the series of elevators with the scoop and a rising and falling earth bed furnished with an apparatus for emptying the same, the whole arranged and acting substantially as herein described.

"I also claim a regulator to the scoop attached in the manner and for the purposes herein specified."

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49. For an *Improvement in Molasses Gates;* Erastus Stebbins, Chicopee, Hampden county, Massachusetts, October 15.

Claim.—"What I claim is the arrangement of the spring, the turning shaft and their bearings, at one end of the gate, and on the side of the screw or seat tube, substantially in the manner above specified, the same giving to my improved molasses faucet several important advantages over that described in the said patent numbered 3002."

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50. For a *Maize Harvester;* William Watson, Chicago, Cook county, Illinois, October 15.

"My invention consists, 1st, in a new method of gathering the ears of Indian corn from the standing stalks by means of a fork which is mounted upon a carriage, and is advanced forwards by horse or other power against the standing stalks beneath the lowermost ears; as the fork is advanced, the stalks are received between the prongs, which near their junction are sufficiently close to each other to retain the ears of corn, while the stalks, being held to the ground by their roots, drag between the prongs and remain upon the field.

"The second part of my invention, which is subsidiary to the first, consists in adapting to a carriage on which one or more gathering forks are mounted, an apparatus, by means of which, the gathered ears are husked and shelled."

Claim.—"What I claim as my invention, is the method substantially as herein described of separating the ears of Indian corn from the standing stalks on which they grow.

"I also claim in combination with gathering forks, apparatus for husking and shelling the corn substantially as herein set forth, whereby the gathering, husking, and shelling of corn are performed at a single operation."

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51. For an *Improvement in Suspender Buckles;* Charles Benedict, Waterbury, New Haven county, Conn., assignor to the Hotchkiss and Merriman Manufacturing Company, Waterbury, Connecticut, October 22.

Claim.—"What I claim as my invention is, the connecting of the wire forming the tongue of the buckle to the outside plate, by means of an eye or hinge formed by bending over a portion of the plate, thus making the whole buckle of but two pieces of metal, also bending or forming the wire which forms the tongue of the buckle in such a manner as to make a lateral spring for securing itself in its proper place; and also the method of securing the points of the tongue by the lateral hooks or guards curved from the sides of the plate in such a manner, as to receive and partially or entirely cover the points of the tongue, and the whole of these contrivances arranged, connected and combined, substantially as herein described."

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52. For an *Improvment in Feeding Apparatus for Straw Cutters;* Henry W. Bertholf, Sugar Loaf, Orange county, New York, October 22.

"The nature of my invention consists in the arranging of the feed box obliquely to the action of the cutters, so as to cut the straw or stalks lengthways or nearly so. Also in arranging the mouth of it, so as to compress the straw or stalk, by means of a lever, weighted or operated by manual pressure, when the knives are in the act of cutting, and thereby preventing it from slipping or drawing from under the edges of the knives."

Claim.—"What I claim, is the use and employment of the adjustable and compressing lid, in combination with the feed roller, and a cutting box having an adjustable block piece to contract the mouth of it, and so arranged as to present the straw or stalk obliquely at different angles, to the action of the knife, and compress it while under its edge, substantially in form and manner as herein set forth."

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53. For an *Improvement in Cheese Presses;* Joseph Card, Fairport, Lake county, Ohio, October 22.

Claim.—"What I claim therein as new, is the elastic strap for raising the platen rod, arranged and operating substantially as herein set forth."

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54. For *Improvements in Machines for Making and Holding Cores for Casting;* Luther H. Crocker, Cincinnati, Ohio, October 22.

Claim.—"What I claim as new, is the combination of the two moving jaws with the stationary piece, said moving jaws being shaped and actuated substantially, in the manner and by the mechanical devices herein specified.

"I also claim keeping the cores straight and stiff in the flasks without the use of anchors, by means of contrivances substantially such as are herein described."

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55. For *Apparatus for Reversing or Stopping Locomotive Engines;* James Cunningham, Reading, Berks county, Pennsylvania, October 22.

Claim.—"What I claim as my invention, is the arrangement and connexion of the system of devices, consisting substantially of a rock shaft, with its hand lever and arms, link-rods, helical segment, drum, sliding key, and oscillating arms, together with the eccentrics and valves, with their respective rods, by means of which the movement of the steam valves of a locomotive engine can be arrested or reversed, with proper lead to reverse the motion of the locomotive, by a single movement of the hand."

56. For an *Improvement in Cotton Presses;* J. T. Elliot, Carrolton, Carrol county,, Mississippi, October 22.

Claim.—"What I claim as my invention, is the employment of the press herein described, so arranged that it may be conveniently charged in an upper story of the building in which it is placed, and actuated and uncharged in a lower story of the same, substantially as herein set forth."

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57. For an *Improvement in Subsoil Ploughs;* William C. Pagett, Xenia, Green county, Ohio, October 22.

Claim.—"What I claim as my invention, is the scoop instrument, with the combination of the cutters in the rear, as a subsoil plough."

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58. For an *Improvement in Apparatus fvr Releasing Horses from Carriages;* Tapley B. Pyron, Salina, Jackson county, Tennessee, October 22.

Claim.—"What I do claim as my invention, is combining two tapered trace bars with the flexible lever or disengaging strap attached to the upper end of the the curved confining box plate, projecting outward from the swingletree, in which the flexible lever and ends of the tapered trace bars fit and are properly secured with the traces; by the curve of the box plate and a guard or holder attached to the flexible lever, and fitting into the cavity cf the box plate directly over the ends of the trace bars, the disengagement being effected by drawing a cord attached to the flexible lever, which will cause it to approximate to a straight line, and with it elevate the ends of the trace bars, and liberate the same from the curved box plate, as fully set forth."

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59. For an *Improved Wrought Iron Railroad Chair;* Edward S. Renwick, City of Washington, October 22.

Claim.—"What I claim as my invention, is a wrought iron railroad chair, with lips formed from that portion of the plate on which the rail is usually supported, substantially as herein set forth."

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60. For an *Improvement in Preparing Beef-steaks for Cooking;* Thomas G. Stagg, City of New York, October 22.

"The nature of my invention consists in employing two rollers having conical or other shaped teeth, by forcing the meat between which rollers, the said teeth are made to act perpendicularly and laterally on the meat, bruising the fibres thereof, and bringing out the juice without mashing or flattening the meat; the upper roller to be supported on a movable lever, that the pressure may be regulated according to the toughness of the meat, or to raise said roller to allow a bone to pass through."

Claim.—"What I claim as my invention, is the preparing beef and other steaks for cooking by running them through toothed rollers, substantially as set forth and described in the specification and drawings."

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61. For an *Improvement in Fastenings of Coulters to Ploughs;* Austin Whittlesy and Austin K. Whittlesy, Spring Port, Cayuga county, New York, October 22.

"The nature of our invention consists in arranging and combining, by a new mode of construction, the different parts of the plough, so as to give greater strength and durability than any other known or used."

Claim.—"What we claim as our invention, is the construction of the double plates, held in parallel position by the combined action of the coulter and the bolts, substantially as described, and for purposes above set forth."

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62. For an *Improvement in Processes for Manufacturing Alum;* Jacob Henry Wurtz, City of New York, October 22.

"The nature of my invention consists in obtaining alum from green sand, by the action of sulphuric acid upon it."

Claim.—"What I claim as my invention, is tho obtaining of alum by the action of sulphuric acid, or its equivalent, upon the substance called green sand, green sand marl, or simply marl."

63. For an *Improvement in Printing;* Bartholomew Beniowski, London, England, October 29; 1850; anté dated November, 1846.

Claim.—"That which I consider new in the above described improvements, is, 1st, marking on the shanks and foot of types by any convenient means, such as writing, engraving, casting, or electrotyping, the same letter or character which is formed on its upper surface, and also the method herein shown and described of casting the intaglio letters on the shank and foot of the types at the same time that the type itself is cast.

"2d, Making types having, in combination with the usual letters in relief on the face of the type intaglio letters on the foot thereof, for the purpose of serving as matrices from which to obtain a polytype plate, while the types themselves will serve for printing.

"3d, I claim casting spaces on the sides of ordinary type, for the purpose above mentioned, as above described.

"4th, I claim the peculiar mode herein shown and described of poly-composing, either from the ordinary cases, or from what I call the authoriton.

"5th, I claim the process and apparatus herein shown and described, for facilitating the sorting and distributing of types and spaces, and making part of them of wood and iron, so that the wooden portion may be separated by means of water, the iron ones by a permanent or temporary magnet, and the others into their several receptacles by hand, the workman being considerably assisted in this operation by the type being marked on their sides.

"6th, I claim the apparatus shown in figures 8, 9, and 10, which I denominate the 'authoriton,' and also of the use of the copying sticks shown in figures 13, 14, and 15, for the purpose of facilitating composition, by which the above described types are brought into a convenient space for composing from, as herein before described."

64. For an *Improvement in Electro-Magnetic Enunciators for Signals in Hotels, &c.;* Charles S. Bulkley, Macon, Bibb county, Georgia, October 29.

Claim.—"What I claim as my invention in my improved electro-magnetic enunciators for hotels, &c., is the manner in which the signal bell, and any one of the signal plates, can be simultaneously acted upon at a distance from the enunciator, through the medium of the galvanic battery; the series of electro-magnets, A and *g g*, and the wires connected with each other with the insulated point, and the shank of the knob, located within the walls of the different rooms, and with the bell and signal plates of the insulator, substantially in the manner herein set forth."

65. For an *Improvement in Winnowing Machines;* J. G. Goshon, Shirleysburg, Huntingdon county, Pennsylvania, October 29.

"My invention consists in the combination and arrangement of a rotating screen, of the form of a frustrum of a cone, composed of two or more sections of different sized meshes, and placed transversely in the position heretofore occupied by the fan and the usual large fan case of the mill."

Claim.—"What I claim as new, is the combination of the additional bottom board with the elevated fan and fan case, for the purpose of diminishing the space between the discharging board and screens for concentrating the blast beneath, and in contact with the screens, for the purpose described."

66. For an *Improvement in Car-Couplings;* Nathan Haskins, Hillsborough county, New Hampshire, October 29.

Claim.—"What I claim as my invention, is the improvement whereby the cars are connected or disengaged under the above named circumstances; or, in other words, I claim the combination of the suspended extension pin, with its weighted pin or arm, or any mechanical equivalent therefor, the hinge and the buffer socket to which they are applied, the same being constructed and made to operate substantially as set forth."

67. For an *Improvement in Corrugated Boilers;* Richard Montgomery, City of New York, October 29.

"This invention consists in forming cylindrical flues, the curved fire arches, and if deemed advisable, the curved shells of boilers of corrugated metal."

Claim.—"What I claim as new, is the employment of corrugated plates of metal for forming the curved arches of fire chambers and shells of steam boilers, the corrugations running in the direction of the curves, substantially as described."

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68. For an *Improvement in Bedstead Fastenings;* John Morrison, McArthurstown, Vinton county, Ohio, October 29.

"The nature of my invention consists in constructing a bedstead fastening by means of a triangular piece of flat iron, the vertex of which is elongated, and in which is cut an ellipse, and in the end of each arm, or of each of the other angles of the triangle, is a hole, which piece of iron being fastened to the post by means of pins passing through the holes in each arm of the piece of flat iron, and by means of a screw or pin, having on it an eccentric or cam, and passing into the rail at the outer extremity of the ellipse, the post is drawn firmly to the rail by turning the screw, until the cam presses against the piece of iron at the outer extremity of the ellipse."

Claim.—"What I claim as my invention, is the construction and application of a triangular or forked plate of iron, made in such a manner as that it can be secured to its place, and draw the post and rail firmly together by means of an eccentric or cam, substantially as above described."

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69. For an *Improvement in Rotary Grain Screens;* Dan. Pease, Jr., Floyd, Oneida county, New York, October 29.

Claim.—"I claim the construction of a rolling screen, consisting of a large and fine, and small and coarse, part, in combination with conductors to carry the grain from the large to the small part, for the above mentioned purpose, and substantially as above described."

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70. For an *Improvement in Machinery for Pressing Hats;* Bennett Potter, Jr., Templeton, Worcester county, Massachusetts, October 29.

Claim.—"I am aware that the smoothing irons in machines for pressing palm-leaf hats have been mounted on a carriage, by which they could be simultaneously brought over the press block into the proper position for the hat to be pressed against them by a second movement, by which the block is raised or the irons depressed. I therefore do not claim merely so arranging the smoothing irons that they can all, by a single movement, be simultaneously brought over the block; I only claim this when the irons are also at the same time, and by the same movement, brought into the requisite contact with the top and sides of the crown, and with the brim of the hat, to smooth and compress the same, substantially as herein specified.

"I likewise claim the devices herein described, or their equivalent, for rendering the crown-iron self-adjusting with respect to the brim-irons, so that the pressure of the crown-iron will be co-etaneous with that of the brim-irons, without affecting the relative degree of pressure with which they respectively bear upon the surfaces to be smoothed by them, substantially as herein set forth."

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71. For *Improvements in Machines for Making Wrought Iron Car Wheels;* Nathan Starks, Albany, New York, October 29.

Claim.—"I claim as my invention, the forging of solid wrought iron wheels, when made by drop and dye, the use ofa lower die or anvil, made to revolve during the process of forging, horizontally on a centralvertical axis, either by hand or by the machinery which operates to drop the ram or hammer, substantially as set forth in the above specification."

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72. For an *Improvement in Reed Musical Instruments;* James P. Sleeper, Worcester, Massachusetts, October 29.

Claim.—"What I claim as my invention, is the improvement of the vibration string or strings, wire or wires, in their combination with the wind chest, the same being made to be vibrated by the air in its passage into or through the wind chest, substantially as specified.

I also claim the above described extension or elongation of the passage, in combination with the improved arrangement of the reed and valve opening, the said arrangement consisting in placing the reed not directly over the valve opening, but at a distance therefrom, and in said passage substantially as specified."

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73. For *Improvements in Machines in Nicking the Heads of Wood Screws;* Thomas J. Sloan, City of New York, October 29.

"The first part of my invention consists in interposing a spring between the griping jaw and the cam or lever which gives the griping motion, that the machine may be self-adapting to the varying sizes of blanks.

"And this part of my invention also consists in so forming or connecting the spring, that its tension may be regulated to suit large and small blanks.

"The second part of my invention consists, in forming the cam which gives the griping operation with a recess or depression, so that directly after the blank has been seized by the jaws, they shall be partly opened for a while, to permit the blank to fall by gravity into its proper position before it is finally griped, to be presented to the nicking saw."

Claim.—"What I claim as my invention, is interposing a spring between the griping jaw and the lever or cam by which it is operated, in the manner substantially as herein described, and for the purpose specified.

"I also claim making the spring which is interposed between the griping jaw and the mechanism which operates it, so that its tension can be varied and regulated in the manner and for the purpose specified.

"And I also claim causing the griping jaw to open slightly after it has seized the blank, to permit the blank to assume its proper position between the jaws before it is finally griped, in manner substantially as herein specified."

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74. For *Improvements in Spike Machines;* Horatio N. Swift, Boonton, Morris county, New Jersey, October 29.

"My invention consists of a machine which will manufacture railroad spikes with great rapidity and perfection of form, giving each spike the proper shaped head, and insuring the bending of it at the proper angle and direction. The spikes are cut off, headed, and completed at one operation, and from the construction of the machine, are necessarily exactly alike in form and size."

Claim.—"What I claim as new therein, is, First, the adjustable cutter when in such position with regard to the dies for holding the spike, that the rod forming the spike is both cut off, and the proper bend given to it to form the head at one and the same operation, during which the spike is held stationary, substantially in the manner described.

"Second: I claim the jaw of the swage, kept open by a spring, in combination with the moving swage, and the stationary swage, the swage (2) having an inclined face, which acting on a similar face on the back of the jaw (3) closes it, for forming the point for the spike, whether placed in front of the revolver to point the rod, or behind it to point the spike, constructed substantially as described."

RE-ISSUES.

1. For an *Improvement in Shanks of Door-knobs;* L. R. Livingston, John J. Roggen, and Calvin Adams, Pittsburg, Pennsylvania; patented July 7, 1846; improvement added December 11, 1847; re-issued October 1, 1850.

Claim.—"What we claim as our invention, is the method of making the shank for door knobs in two pieces, coupled together near the middle by a notched connexion, and held together by means of the escutcheon at one end, and the latch bolt, (or by the tumbler that operates a latch bolt,) at the other, substantially as herein described.

"We also claim the constructing the keeper, and the lever fastener, of such shape and proportions that the keeper can be reversed in its position upon the latch plate: and the lever fastener be reversed in its position in relation to the keeper, for the purpose of adapting our improved lock or latch to doors opening either to the right or to the left, substantially as herein set forth.

"We also claim the connecting the respective shanks of the knobs to each other and to the lock or latch, by means of the tooth in the halved portion of one shank fitting into an aperture in the halved portion of the other, and the two being confined to each other by the tumbler, the tube, projecting from the side of the lock or latch, and the escutcheon, secured to the door, substantially in the manner herein set forth."

2. For an *Improvement in Mills for Grinding Bark;* Sidney A. Bantz and William Andrews, Frederick, Frederick county, Maryland; patent December 4, 1849; re-issued October 15, 1850.

"Our invention consists, 1st, in giving a vibratory motion to the concave, so that it shall diverge from, and close towards, the cylinder, whereby a drawing motion is communicated to the teeth which thus cut as well as crush the bark; 2d, in the peculiar form given to the teeth of the concave, which increases their strength and enables them to act more effectually on the bark."

Claim.—"What we claim therein as our invention, is the vibratory motion given to the concave, substantially in the manner herein set forth."

3. For an *Improvement in Portable Furnaces;* Merritt F. Potter, Charlemont, Massachusetts; patented January 22, 1850; re-issued October 22, 1850.

Claim.—"I claim as my invention, the construction of a portable furnace, by which it may be connected with a stove in the manner described: that is, a furnace adapted to the boiler, or other hole of a stove, with a downward draft or diving flue for the escape of the smoke through the bottom into the stove, substantially in the manner and for the purposes set forth."

Designs.

1. For a *Design for Stoves;* Anthony W. Jones, City of New York, assignor to Edward R. Brown, Albany, New York, October 1.

Claim.—"What I claim as my production, is the combination and arrangement of ornamental figures and forms represented in the accompanying drawings, forming together an ornamental design for a parlor stove."

2. For a *Design for Grate Frame and Fender;* James L. Jackson, City of New York, October 15.

Claim.—"What I claim as my production herein, is the combination and general arrangement of the figures and ornaments as set forth and shown in the drawings herein described, for forming an ornamental grate frame, summer piece and fender, substantially as described."

3. For *Design for Stoves;* Ezra Ripley, Troy, New York, assignor to George W. Eddy, Waterford, New York, October 22.

Claim.—"What I claim as new, is the design of ornament, shape, and configuration of parlor stove plates, as described and represented in the annexed drawings."

4. For a *Design for Stoves;* Ezra Ripley, Troy, New York, assignor to George W. Eddy, Waterford, New York, October 22.

Claim.—"What I claim, is the design and configuration of ornamented parlor stove plates, substantially the same as described and represented."

5. For a *Design for Stoves;* Laban Eddy, Taunton, Massachusetts, October 29.

Claim.—"What I claim as my invention, is the ornamental composition of each foot.

"I also claim the ornamental composition of either the base, the cornice, or the blockings, as well as a combination of the whole of the same.

"I also claim the ornamental composition or design for the main oven door, as well as that of either of the small doors."

6. For a *Design for Iron Railings;* William Ballard, City of New York, October 29.

Claim.—"What I claim is the particular ornamental design or device for a railing and gate posts, as herein combined and specified: that is, the posts, panel and marginal grape vine base in form and design, substantially as herein set forth."

NOVEMBER.

1. For an *Improvement in Machines for Dressing Irregular Forms;* Alanson Cary, Worcester, Massachusetts, November 5.

"The nature of my invention consists in a horizontal bench, in or near the centre of which is a circular table, which is fitted in such a manner to the bench as to be capable of receiving a circular motion; the table carries two slides, placed at right angles, one above the other, the lower one capable of sliding in a line across the circular table, and the upper one sliding in rebates or guides in the lower one at right angles to the direction in which the lower one itself slides; the work to be operated upon is secured by dogs to a plate above the top slide, and by the means hereinafter described, receives such a motion that a fixed point will mark the required pattern on the work; a rotary cutter is suspended on a swinging arm above the work; this is capable of being adjusted to take a cut of the required thickness, and while motion is given to the work in the required direction, it will cut it to the required form."

Claim.—"I claim the toothed wheel upon the shaft, arranged so that it is capable of being thrown in gear with either of the racks, in combination with the dog on the slide and the notched projection on the table, by which the slide is locked to or unlocked from the table for the purpose of enabling the wheel to give either a rectilinear motion to the said slide, or a circular motion to the table, as may be required, in the manner and for the purposes substantially as herein set forth."

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2. For an *Improvement in Rotary Pumps;* William H. Davis, Maysville, Mason county, Kentucky, November 5.

Claim.—"What I claim as new, is the two pistons acting alternately with each other as rotary pistons, and as stationary partitions, in connexion with the arms and apparatus by which they are worked, substantially as above set forth."

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3. For au *Improvement in Furnaces for Steam Boilers;* F. P. Dimpfel, Philadelphia, Pennsylvania, November 5.

"The nature of the first part of my invention consists in making a hollow or box lining, with a partial partition or partitions interposed between the outer shell and inner lining, so that the air, whether introduced under pressure or by draft, shall rise between the outer shell and the partition or partitions, and then over the upper edge thereof, and then down and through the inner lining to the fuel contained therein.

"And the second part of my invention consists in making the furnace door with an inner plate or lining, separated therefrom, so as to leave an open space for the passage of a cooling medium, such as cold air, steam, or water; the said door so constructed being combined with a tube or tubes, or apertures for the passage of the said cooling medium."

Claim.—"What I claim as my invention, is the method substantially as described of making the box lining of furnaces, with a partition or division plate or plates between the inner lining and outer shell, to direct the current or currents of air before entering the fire, substantially for the purpose and in the manner specified.

"I also claim the manner of arranging the furnace door with its interior plate or lining, in combination with the tube or apertures for blowing or forcing in air, steam, or other cooling medium, between the door and said plate, all as herein described, irrespective of form; and also of the manner of producing the forced current of the cooling medium."

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4. For an *Improvement in Washing Machines;* Richard A. Fisher, Sunbury, Northumberland county, Pennsylvania, November 5.

Claim.—"What I claim as my invention, is the arrangement of three vertical pressers or washers, in combination with the fan, arranged and operated in the manner and for the purposes above set forth."

5. For *Improved Valves for Governers;* Junius Judson and Alfred Judson, Rochester, Monroe county, New York, assignors to Junius Judson, Rochester, New York, November 5.

[At the request of the patentee, the description of this invention is postponed for the present.]

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6. For an *Improvement in Straw Cutters;* A. S. Macomber, Bennington, Bennington county, Vermont, November 5.

"The nature of my invention consists in dispensing with the ordinary feeding rollers, and using rotary spiral cutters, in combination with a stationary knife, placed across the mouth of the straw cutter, one rotary cutter being placed above the edge of the knife and another below it; the edges of the rotary cutter come in contact with the edge of the stationary knife, and produce a cutting effect nearly similar to that of a pair of shears, the rotary cutters feeding themselves and leading the straw."

Claim.—"What I claim as new in my invention, is the application and use of rotary spiral cutters, which are self-feeding, in combination with a stationary knife, or cutting edge, in the manner and for the purpose substantially as described."

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7. For an *Improvement in Lime Kilns;* William McCoy, Fannettsburgh, Franklin county, Pennsylvania, November 5.

Claim.—"What I claim therein as new, is, 1st, the construction of an upper tier or tiers of arches, in the manner and for the purpose herein fully set forth.

"2d, I claim the recesses or openings, in combination with an upper tier or tiers of arches for the purpose of creating a draft through the structure after the lower arches have become stopped up."

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8. For an *Improvement in the Running-gear of Carriages;* Joseph Pine, City of New York, assignor to Benjamin Pine, City of New York, November 5.

"The nature of my invention consists in providing the pole of the carriage with an interior rack on its inner end, meshing into a central cog-wheel, which operates the axles on the front wheels, each of which has a rack on its inner end; also, in combining the front central cog-wheel with the hind central cog-wheel by diagonal braces, which operate the axles of the hind wheels in unison with the motion of the front wheels, the whole being operated by the pole of the carriage to move the wheels to the requisite angles for turning the corners of streets abruptly, and also for preventing the wheels from being turned out of their course, unless operated by the pole of the carriage."

Claim.—"I do not claim a separate axle for each wheel, neither do I claim the diagonal braces for uniting the front or back axles, as these have been known before; but what I do claim, is the axles of the wheels having racks on their inner ends meshing into central cog-wheels, the front one of which meshes into a segmental rack on the inner end of the pole of the carriage, the whole being constructed, arranged, and operating in the manner substantially as described."

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9. For an *Improvement in Operating the Copping Rail of Cop-spinners;* Wanton Rouse, Taunton, Bristol county, Massachusetts, November 5.

"The nature of my invention consists in a new and improved mode of operating and changing the speed of the upward and downward motions of the ring rail for governing the winding of the thread in forming the cops."

Claim.—"What I claim as new in my invention, is changing the direction in which the ring rail is moved, and the speed at which it is operated, for the purpose of governing the winding of the thread on the cop, and forming a bind thread, by means of the combination of the shaft, M, having a toothed wheel, N, and smaller wheel, O, fast upon its axis, with the shaft R, having on it a fast toothed wheel, S, and a loose smaller wheel or pinion, V, operated by shifting belts and pulleys, or other similar changing or reversing gear."

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10. For an *Improvement in Hardening Fats and Oils;* Carl W. Schindler, City of New York, November 5.

"The nature of my invention consists in imparting to every kind of fat and oil without separating the stearine from the oleine, such a degree of hardness that it can withstand a heat of at least 135 degrees Fahrenheit without melting, even in water heated to that degree."

Claim—"What I claim as my invention, is the hardening of fatty or oily substances without separating the stearine from the oleine to such a degree that they can withstand a heat of at least 135 degrees Fahrenheit without melting; using for that purpose the ingredients of cera japonica and gum elemi, in the manner and proportions above described, which will produce the intended effect."

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11. For an *Improvement in Clamps for Girding Emery Wheels;* Henry S. Vrooman, Springfield, Hampden county, Massachusetts, November 5.

Claim.—"What I claim as my invention, is the combination of the screws, and toggle-joint, with the jaws, substantially as herein described and set forth, for the purpose of producing, 1st, tension of the girding substance, and then the compound motion of the jaws, in closing together and settling down to the object on which the machine rests."

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12. For an *Improved mode of Fastening Hooks and Eyes upon Cards;* Ezra J. Warner, Waterbury, New Haven county, Connecticut, November 5.

Claim.—"What I claim as my invention, is the putting on of the hooks and eyes in such a manner upon paper, perforated as herein described, that the points of the hooks are upon one side of the sheet, and the eyes upon the other side, thereby securing the eyes against dropping off from the hooks. I claim nothing in regard to the manner of perforating or folding the paper."

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13. For an *Improvement in Fly-Brushes;* Samuel R. Wilmot, Lafayette, Tippecanoe county, Indiana, November 5.

Claim.—"What I claim as new, is so constructing and adapting the revolving fan or brush, that it may be placed like a lamp upon a table, or may be fixed to the walls or ceiling of a room, or that it may be suspended by a cord over a bed, sofa, or cradle, by the means herein fully described."

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14. For an *Improvement in Apparatus for Stretching and Smoothing Cloth;* John Butcher, Lowell, Middlesex county, Massachusetts, November 5.

Claim.—"What I claim as my invention, is the combination of the revolving platform or table, and the guide roller or apparatus, with the series of stretching rollers; the whole being substantially in the manner and for the purposes as herein before specified."

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15. For an *Improvement in Portable Furnaces;* John P. Hayes, Boston, Massachusetts, November 5.

Claim.—"What I claim as my invention, is a summer furnace in which the draft is derived to the fire chamber from the exterior of the furnace, and at the bottom of the same, and passes first up through a flue chamber, (formed between the partition *i i* and the periphery of the furnace as above set forth,) and then down through the fuel, all as herein above set forth, and for the purpose specified."

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16. For an *Improvement in Processes for Curing Meat;* George Starkweather, Hartford, Connecticut, November 5.

"My invention consists in subjecting the meat in brine to the joint action of atmospheric pressure and agitation; this is effected by introducing the meat and brine into a turning vessel within which the pressure of the atmosphere is alternately removed by an exhaust pump, and re-applied as often as may be necessary to effect the curing of the meat.

Claim.—"I make no claim to the curing of meat by mere agitation in brine; nor to the saturation of meat with brine by alternately withdrawing and re-applying the pressure of the atmosphere, without at the same time agitating the meat; but, what I do claim as my invention, is the method of curing meat by placing it with brine, within a vessel, and then subjecting it to the combined action of agitation, and an alternate increase and diminution of atmospheric pressure substantially as herein set forth."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Reply to the Objections of "M." (Published in the October Number, page 260,) to a Comparison Between the Radial and Perpendicular Paddle Wheels for Steamers. By B. F. Isherwood, *Chief Engineer U. S. N.*

The main objections are the dissimilarity of the experimental vessels and the manner in which the calculations are made. They are easily answered. The vessels were selected, though differing much in size, because their performances had been accurately ascertained by trial at a "measured mile" up and down on the Thames river; that is, their speeds, number of revolutions of the wheels, dip of paddles, and all other necessary data had been exactly observed, with the single exception of the steam pressure in the cylinder; and no other data in my possession on vessels approximating each other more nearly in size had this exactness. Now it is perfectly well known to all engineers, that with the usual speeds of piston and areas of steam passages, that with wide throttles, the initial steam pressure in the cylinder can be very nearly deduced from the boiler pressure, being from 1½ to 2½ pounds less, or a mean of 2 pounds, and this has been the unvarying result as shown by a great number of indicator cards taken from various English and American steamers; indeed, after an inspection of many, I cannot recollect having seen one, in which the variation from the boiler pressure did not lie between the above limits. In my calculations, the horses power was deduced from the boiler pressure minus 2 pounds, the back pressure in the cylinder being taken at 4 pounds, which has been shown by many indicator cards to be a mean; the expansion was calculated by hyperbolic logs, the point of cutting off having been given. I am therefore warranted in believing the powers to be very near the truth. Supposing, however, that the initial pressure in the cylinder could not be reliably deduced from the boiler pressure, yet as the same steam pressure was carried in the boilers of each engine, and as the speeds of the pistons compared as 1·00 and 1·03—the steam passages being of usual proportions, there is every reason to presume the variation of the cylinder from the boiler pressure would be the same in each case, consequently no error in the comparison would flow from this.

It is also objected that "*the most important circumstance of all, viz., the consumption of fuel, is entirely neglected.*" Now, the only possible connexion which the consumption of fuel can have with the question, is as the measure of the powers of the engines, and of all measures of the powers of steam engines, the consumption of fuel is the most uncertain; indeed, so widely differing from the truth, that when no other measure can be obtained, comparisons are wholly impossible, and for the following among many reasons. It has been ascertained from the carefully made experiments of Smeaton, that the evaporating power of the different kinds of coal in use in England varies from 86 to 133; further, that with the same coal, burned on the same grate beneath the same boiler, the difference between the results obtained from a well managed fire, is $\frac{1}{6}$th greater than from an ill managed one, where the coal is filled in too thick or unevenly, or is too seldom or too much stirred. If, in addition to these, we add that the evaporation obtained from a given weight of fuel depends altogether on the proportions and type of boiler as well as on the incrusations that may cover its fire surface, it will be perceived as has been judiciously remarked by Pambour, that "*with respect especially to the effects attributable to the consumption of a given weight of fuel, nothing can be more uncertain.*" Indeed, these effects often range from 43 to 100 for the same weight of fuel.

I have already given the reasons which determined the selection of the experimental vessels, but "M." objects to the manner in which I have calculated their coefficients of resistance, without having the remotest idea of that manner; for he represents, or rather misrepresents me as making that calculation in the following absurd manner, viz.—

> "He assumes the hull resistances to be in the ratio of the squares of their midship sections divided by their displacements."

Now, no such assumption is anywhere made by me, and in reply to this objection I need only quote what I did assume, viz.:—

> "The vessels are, however, of different dimensions, and the power required to propel them at equal speed will be as their resistances multiplied by their respective immersed amidship sections. These resistances will be in the compound ratio of their immersed amidship sections and displacements."

And again:

> "The coefficients of resistance for the hulls will be obtained as follows: The vessels having about the same proportions between length and beam, their resistances (that is the relative resistances of their models) may be considered as their displacements and immersed sections."

The meaning of the above quotations is, I believe, pretty clear. The hypothesis assumes the resistance of the hulls to be in proportion to their immersed amidship sections multiplied by a coefficient representing the fineness of the water lines. Now it is evident, that of the immersed part of two hulls, the hull having the less displacement (true displacement, not custom-house tonnage) proportionally to its greatest immersed section, will have the finest water lines, and consequently the compound ratio of the sections and displacements of two hulls of nearly similar proportions between the length, breadth, and depth of their immersed portions (not length, breadth, and depth measured from the deck, which "M" objects to in the vessels of my data for wanting similarity, as though those elements entered at all into the calculation,) will give comparatively the resistances in function of model. To quote again from my previous article:

> "To obtain the absolute resistances of the vessels, the above resistances in function of model must be multiplied by their respective amidship sections. This product represents relatively the proportions of power required to propel the vessels at equal speed."

The coefficients of resistance obtained by this method of calculating are a very close approximation to the truth, and I have often verified the accuracy of the method from reliable data on steamships propelled with the common radial paddle wheel, which, as it allows the disposition of power to be wholly accounted for, permits the hull's coefficient of resistance to be ascertained. In the comparison between the "Black

Eagle" and "Trident," these coefficients could not be thus determined, because the friction of the eccentric strap and of the jointed levers of the "Black Eagle's" wheel was an unknown quantity to be determined by the coefficient of the hull obtained in another manner. And this brings me to the second main objection of "M," which is to my method of calculation, and is expressed as follows:

> "It will be observed that in his calculation of powers, Mr. I., instead of deducting only the slip, and the power required to work the air-pumps, &c., thus leaving the whole available powers of the engines to be compared with each other, and with the effects produced, (the friction being of course proportional to the load,) has deducted also the (calculated) elements of oblique action in one wheel, and reaction in the other, which being precisely the causes of economical difference between the two kinds of wheel, are precisely those which should have been left to be determined by the results of the comparison; so that in fact the only thing really proved by that comparison as made by him, is that either his powers or his effects are erroneously calculated.
>
> "If this be not the case, where does the difference go? To what is owing the ratio of 1·0000 to 0·9055? The author first calculates the respectively disputed elements—deducts them from his powers, thus reducing the wheels to an equality in effect; and then, because the powers so obtained do not correspond with the resistances he has calculated, we are told the difference is owing to the respective values of the two wheels."

The whole of the above quotation is a misapprehension. In the first place, the losses by the oblique action of the radial paddle, and by the reaction of the perpendicular paddle are not by any means "*the causes of economical difference between them.*" With the perpendicular paddle wheel, provided a slip normal to the immersion of the paddle be given, there will be no loss at all by reaction:—a reactionary loss is not a necessary consequence of employing a perpendicular paddle wheel and never obtains in a well proportioned one. The "causes of economical difference" are slip plus oblique action with the radial paddle wheel, and slip plus the *friction of the eccentric strap and jointed friction levers* in the perpendicular paddle wheel, to which must be added, when it obtains by employing injudicious proportions, the reactionary loss. "M." also says, that when the losses by slip, and the power required to work the air pumps have been deducted, the remainders are the available powers to be compared. Now it is at once evident that the available powers, that is, the powers available to propel the vessels; will be those remaining after deduction has been made for slips, oblique action, reactionary losses, and all kinds of friction, both of the load and the engine, and the gearing of the perpendicular paddle wheel. These remainders would be the true available powers, and supposing the relative resistances of the vessels to be accurately obtained for equality of speed, it is evident these remainders should have the same relation to each other as the resistances of their respective vessels. Now in the calculations on the "Black Eagle" and "Trident," there was calculated for the "Trident" ALL the losses due to the friction of the load, to the engine, and to the radial paddle wheel; and for the "Black Eagle" there was calculated *all* the losses due to the friction of the load, to the engine, and to the perpendicular paddle wheel, EXCEPT that due to the *friction of the eccentric strap and jointed levers* of the perpendicular paddle wheel. The remainder of available power belonging to the "Black Eagle" would then be *too much* by the amount due to this friction; there would therefore *not* be an equality between the remainders, (proportional to the resistances,) and the difference between the remainder as obtained, and as it should be to have this equality, will be the measure of the power absorbed in the friction of the eccentric strap, jointed levers, &c.; but, indeed, the whole of this is so clear in the original article, that the best reply to "M.'s" objections is to quote its language as follows:—

> "The calculations we are about to make, have for their object the determination of the friction of the lever journals, and of the eccentric strap of the perpendicular paddle, in per cents. of the total power developed by the engine. To effect this, there must be calculated for the two vessels the losses (omitting the friction loss by the perpendicular paddle wheel) by their respective paddle wheels, viz: in the 'Black Eagle' by slip and reaction, and in the 'Trident' by slip and oblique action. To these must be farther added the power, in per cents., which has been found in practice required to work the engine, and to overcome the friction of load. The remainder of the power will be considered as that utilized in the propulsion of the vessel. The vessels, however, are of different dimensions, and the power required to propel them at equal speed will be as their resistances multiplied by their respective immersed amidship sections. These resistances will be in the compound ratio of their immersed amidship sections and displacements The previous remainder of the power being multiplied by these coefficients of resistance inversely, will represent the powers proportionally to the resistances they overcome. The final comparison is now readily made, by taking these proportional powers as the measure of the powers, and the cubes of the speeds of the vessels as the measure of the effects.
>
> "If now our data were exactly correct, and there were no loss of labor by the friction of the perpendicular paddle wheel, the final comparison would show, in each case, the powers to bear equal proportions to the cubes of their respective speeds; assuming the data to be correct, there will remain the loss by friction of the perpendicular wheel included in the final comparison, which will then not show the powers to bear equal proportions to the cubes of the speeds, and the discrepency is the measure of the power absorbed in the friction of the perpendicular paddle wheel."

The calculations being made, the final comparison stood as follows:

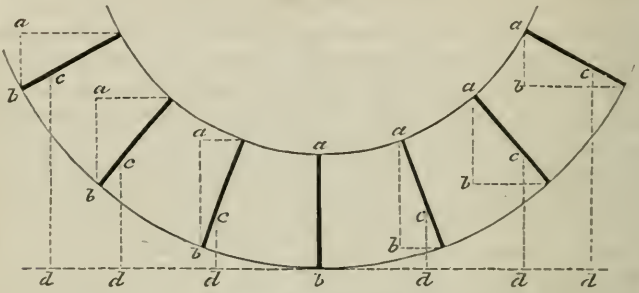
	"Black Eagle."	"Trident,"
Powers, . . .	1·0000	0·8245
Effects, ...	1·0000	0·7466

And 8245 : 7466 :: 1·0000 : 0·9055.

> "That is to say, the result of the applicatian of the power in the 'Black Eagle' is better in the proportion of 1·0000 to 0·9055 than in the 'Trident,' according to the calculation, and the calculation includes as utilized power in the 'Black Eagle,' the power necessarily absorbed by the friction of its perpendicular paddle wheel. But as allowance for the different resistances of the hulls has been made, the discrepency in the calculation is produced by, and is equal to, the power absorbed in this friction, and this discrepency is 1·0000—0·9055=0·0945, and 0·0945 is 9·45 per cent. of the total power 1·0000 of the 'Black Eagle,' 9·45 per cent. of the total power is therefore the loss by friction of the perpendicular paddle wheel of the 'Black Eagle.'"

"M." will probably now understand "to what is owing the ratio of 1·0000 to 9·9055," and why "because the powers so obtained do not correspond with the resistances I have calculated, we are told that the difference is owing to the respective values of the wheels," whereas, in fact, he is only told that the difference is owing to the friction of the eccentric strap and jointed levers of the perpendicular paddle wheel.

"M." has also adopted several errors with regard to paddle wheels, especially that which relates to the cycloidal action of the paddle through the water. People have confused themselves after tracing the cycloidal path of the paddle by considering it as relative to its action on the *water*, when it is in truth only relative to the *motion of the vessel*. The action of the paddle on the water when the vessel is in motion, is precisely the same as when the vessel is at rest, as far as the oblique action of the radical paddle is concerned; and furthermore, in direct opposition to "M," the radical paddle, when in vertical position, is the most effective for propelling purposes, all of which is clear from the following reasons:



☜ Direction of Keel.

The propelling efficiency of any paddle is as its projected surface *a b*, in the direction of the keel of the vessel, multiplied by the square of its velocity (that is by the square of its *horizontal* velocity) in the *same direction.* By referring to the diagram it will be seen that when the paddle is vertical, it gives the greatest projection in the direction of the keel, and that that projection diminishes as we recede from the vertical position. Furthermore, the horizontal speeds of the different paddles will be obtained relatively by dropping from the centre of reaction of each paddle, perpendiculars *c d*, on a horizontal line; the spaces *d d* will represent comparatively the horizontal speeds of the paddles. Hence to give equal slips, the total amount of projected propelling surface in the perpendicular paddles must be made equal to the total amount of projected surface with the radial paddles; but when a small wheel (compared to its vessel) is used, it must have a deep immersion to obtain sufficient propelling surface, and if the wheel have radial paddles, this deep immersion will operate an enormous loss by the oblique action of the paddles, to avoid this loss the wheel must be made larger so as to give the same immersed paddle surface with less immersion of the wheel. From this it obviously follows that the perpendicular paddle wheel operating with simply the losses from its slips and the friction of the gearing of the wheel, for it need have no reactionary losses; and having no loss from oblique action, can be immersed to a greater depth than the radial paddle wheel, and consequently a wheel of less diameter will have equal propelling efficiency; beside, each paddle giving a maximum projection in the direction of the keel, there is no surface lost by the obliquity of the radial paddle, from this results a further reduction in the length of the paddle.

I shall only notice one more of "M.'s" errors, and that only as a specimen of his reasoning. He says, that upon the trial of two equal and in all respects similar steamers, except in kind of wheel, one being propelled with the common radial paddle, and the other with the perpendicular paddle, that in order to attain equal speeds, the perpendicular paddle wheel had to make two more revolutions per minute, "*of course involving a greater consumption of fuel.*" Now with the same diameter from outside to outside of paddles, the diameter of the circle of the centre of reaction will be less with the perpendicular than with the radial paddle, the relative proportions of the breadths of the two paddles being about as 2½ to 4½. Now the leverage of the paddles on the same engine will be as the radii of their respective circles of the centre of reaction, consequently the load upon the engine with the perpendicular paddle wheel will be less, revolution for revolution, than with the radial paddle wheel, and if the load be less, there will be required less steam to move it; so it is easily perceived that the "of course" involves a *less* instead of an *equal* consumption of fuel, revolution for revolution. The diameter of the circle of the centre of reaction of the perpendicular paddle wheel being less than that of the radial paddle wheel, there will, "of course," be required more revolutions of it to go a given distance, but there will also be a proportionally less power required to make a revolution, in the same manner that a small wheel must turn oftener than a large one in traversing the same road, but I believe "M." is the first discoverer that it "of course" involves a greater expenditure of power, and I leave him to the credit of his discovery, reaffirming the truth of the theory, data, and calculations of my original article on the two kinds of wheels.

With regard to the trial quoted by "M." as made with the two kinds of wheels at Maudslay & Field's works, it was made without any sagacity of method, and both the experiment in its conduct and the conclusions drawn from it, are erroneous, and could easily be so proven had I not already exceeded the proper limits for this reply.

New York, November 9, 1850.

Note by the Editor.—We insert the reply of Mr. Isherwood to our correspondent "M.," omitting, however, and altering so much as was necessary to destroy the disagreeable personalities which Mr. I. has been pleased to introduce into the discussion. Our alterations have in no wise altered the sense or the strength of Mr. I.'s arguments and affirmations, which must, of course, go for what they are worth. He was entitled to reply, but our Journal cannot be made a vehicle for personal abuse.

On the Heat of the Vaporization of Water. *By* J. P. Joule.*

The object was to point out the complex nature of the heat hitherto taken from the latent heat of steam. In the exact experiments of Regnault 965° was found to be the quantity of heat evolved in the condensation of steam saturated at 212°; of this quantity, 75° is the heat due to the *vis viva* communicated by the pressure of the steam, leaving 890°

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* From the London Civil Engineer and Architect's Journal, for November, 1849.

as the true heat of vaporization of water. In a perfect steam engine supplied with water at 212°, and worked at atmospheric pressure without expansion, 965° will be the heat communicated from the fire to the boiler, 75° will be the heat utilized by conversion into force, and the remainder, 890°, will be the heat given out in the condenser.—*Proc. Brit. Assoc., Sept.* 1849.

On Atlantic Waves, their Magnitude, Velocity, and Phenomena. By Dr. Scoresby.*

During *two* passages across the Atlantic in 1847–8, I had opportunities for investigating certain elements respecting deep sea waves more favorable than had ever before occurred within my experience in navigation. These observations, it should be noted in the outset, and the results deduced from them, were entirely uninfluenced by, and separate from theory. They form but a contribution to this interesting branch of natural phenomena; but I offer them the more readily from the circumstance of their entire independency and speciality. It was in our return voyage from America that the highest seas occurred, when the circumstances adapted for interesting observations were singularly favorable; for, whilst the magnitude and the peculiar construction of the upper works of the ship—the Hibernia—afforded various platforms of determinate elevation above the line of flotation for observations on the height of the waves, the direction of the ship's course, with respect to that of waves, was generally so nearly similar as to yield the most advantageous agreement or accordance for observations on their width and velocity. These observations I shall extract, in their order, from my Journal kept during the homeward passage. My first observation worth recording, is under the date of March 5, 1848, when the ship was in latitude about 51°, and longitude (at noon) 38° 50′ W.—the wind then being about W.S.W., and the ship's course, true, N. 52° E. At sunset of the 4th, the wind blew a *hard gale*, which, with heavy squalls, had continued during the night; so that all sail was taken in but storm-staysail forward. The barometer stood at 29·50 at 8 P.M., but fell so rapidly as to be at 28·30 by 10 the next morning. In the afternoon of this day, I stood some time on the saloon deck or cuddy roof,—a height, with the addition of that of the eye, of 23 feet 3 inches above the line of flotation of the ship—watching the sublime spectacle presented by the turbulent waters. I am not aware that I ever saw the sea more terribly magnificent. I was anxious to ascertain the height of these mighty waves; but found almost every wave rising so much above the level of the eye, as indicated by the intercepting of the horizon of the sea in the direction in which they approached us, as to yield only the *minimum* elevation, and to show that the great majority of these rolling masses of water possessed a height of considerably *more* than 24 feet, (including depression as well as altitude,) or, reckoning from the mean level of the sea, of *more* than 12 feet. Exposed as the situation was, I then adventured to the larboard paddle box, which was about 7 feet higher, where the level (as ascertained afterwards at Liverpool, allowance being made for the alteration in the draft of water of the ship,) was 24 feet 9 inches above the sea. This position, with 5 feet 6 inches, the height of my eye, gave an elevation altogether of 30 feet 3 inches for the level of the view then obtained,—a level, it should be remarked, which was very satisfactorily maintained during the instants of observation, because of the whole of the ship's length being occupied within the clear "*trough* of the sea," and in an even and upright position, whilst the nearest approaching wave had its maximum altitude. Here, also, I found at least *one-half* of the waves which overtook and passed the ship were far above the level of my eye. Frequently I observed long *ranges* (not acuminated peaks) extending 100 yards, perhaps, on one or both sides of the ship,—the sea then coming nearly right aft,—which rose so high above the visible horizon, as to form an angle estimated at 2 to 3 degrees (say 2½°) when the distance of the wave summit was about 100 yards from the observer. This would add near 13 feet to the level of the eye. And this measure of elevation was by no means uncommon,—occurring, I should think, at least once in half a dozen waves. Sometimes peaks of crossing or crests of *breaking* seas would shoot upward at least 10 or 15 feet higher. The *average wave* was, I believe, fully equal to that of my sight on the paddle-box, or more,—that is, $\frac{30}{2}=15$ feet or upwards; and the *mean highest waves*, not including the broken or acuminated crests, about 43 feet above the level of the hollow occupied at the moment by the ship. Illuminated as the general expanse not unfrequently was by the transient sunbeam breaking through the heavy masses of the storm-cloud, and contrasting its silvery light with the prevalent gloom, yielding a wild and partial glare, the mighty hills of waters rolling and foaming as they pursued us, whilst the gallant and buoyant ship—a charming "sea-boat"—rose abaft as by intelligent anticipation of their attack, as she scudded along, so that their irresistible strength and fierce momemtum were harmlessly spent beneath her and on her outward sides,—the storm, falling fiercely on the scanty and almost denuded spars and steam chimney raised aloft, still indicated its vast, but as to us innoxious, power, in deafening roarings,—altogether presented as grand a storm-scene as I ever witnessed, and a magnificent example of "the works of the Lord," specially exhibited to sea-going men, "and his wonders in the deep." In the afternoon of the same day, the gale again increased, blowing, especially during the continuance of a much protracted hail-shower, terrifically—roaring like thunder, whilst we scudded before it, causing the ship to vibrate as by a sympathetic tremor, and the tops of rolling waves, too tardy, rapid as was their actual progress, for the speed of the assailing influence, to be carried off and borne along on the ærial wings in a perfect drift of spray! But during the period of these most vehement operations of nature, I was fortunately enabled, from familiarity with sea enterprise, to pursue my observations with entire satisfaction. The next day, March 6, added to the interest of these investigations by developing the character of the Atlantic waves under a long and fiercely continued influence of a little varying wind. It had blown a heavy gale, violent in the showers, from the north-westward, from Saturday evening the 4th, to the evening of Sunday, from 26 to 30 hours; during the night, too, of Sunday it had again blown hard (abating towards the morning of Monday), and making a total continuance of the storm, in *its violence*, of about 36 hours.* I renewed my observations on the waves at 10 A. M., the storm having been then subdued for several hours, and the height of the waves having perceptibly subsided. Soon I observed, when standing on the saloon-deck, that ten waves, in one case, came in succession, which all arose above the apparent horizon, consequently they must have been more than 23 feet, probably the *average* might be about 26 from ridge to hollow. At this period I also found that occasionally, (that is, once in about four or five minutes,) three or four waves in succession, as seen from the paddle-box, rose *above* the visible horizon, hence they must, like those of the preceding day, have been 30 feet waves. But one important *difference* should be noted, viz: that they were of no *great* extent on the ridge, presenting, though more than mere conical peaks, but a moderate elongation. Another subject of consideration and investigation, on this occasion, was the period of the regular waves overtaking the ship, and the determination, proximately, of the actual width or intervals, and their velocity. 1. The ship was then going *nine* knots only, the free action of the engines being greatly interfered with by the heavy sea running, and the lines of direction of the waves and the ship's course differed about 22½ degrees, the sea being two points on the larboard quarter,—in other words, the true course of the ship was east; the direction *from* whence the sea came was W.N.W. 2. The period of regular waves, in incidental series, overtaking the ship were observed as follows:—

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* From the London Athenaeum, August, 1850.

Waves.		Min.	Sec.	Mean.
20	occupied	5	30	16″·5
10	"	2	35	15 ·5
10	"	2	50	17 ·0
10	"	2	45	16 ·5
8	"	2	16	17 ·0
General Average,		.	.	16 ·5

3. The length of the ship was stated to be 220 feet. The time taken by a regular wave to pass from stern to stem appeared, on a mean of several observations, to be about six seconds. Hence 6″ : 220 feet (the width passed over in that time) :: 16·5 feet to 605 feet (the width passed over betwixt crest and crest.) But this extent, by reason of the obliquity of the direction of the waves to the course of the ship, is found to be elongated about 45 feet, reducing the probable mean distance of the waves to 559 feet. Independently of this process, I had previously estimated the distance of the wave crests, ahead and astern when the ship was in the hollow, as I stood near the centre of the ship's length on the paddle-box, at 300 feet each way, by comparing the intervals betwixt my position and the place of the wave crest, with the known length of the ship. This comparison frequently reconsidered and repeated, subsequently yielded, in much accordance with the former, a total width, in the line of the ship's course, of about 600 feet. 4. But the total distance betwixt the

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* The barometer on Saturday, at 8 P. M., was at 29·50; at 6 A. M. of Sunday it had fallen to 28·30, being 1·2 inches in 10 hours. At 6 P. M. of the latter day, it had risen to 30·00 inches.

crests of two waves, then reckoned at 550 feet, a distance passed by the wave in 16·5 seconds of time, by no means indicates, it is obvious, the real velocity of the wave, as the ship meanwhile was advancing nearly in the same direction at the rate of nine knots, that is nine geographical miles, or (6,075·6 feet × 9 =) 54,680·4 feet per hour, or 15·2 feet per second. During the time, therefore, of a wave passing the ship = 16·5″, the ship would have advanced on its course 16·5 × 15·2 = 250·6 feet. Reducing this for the obliquity of two points we have 231·5 feet to be added to the former measure, 559 feet, which gives 790·5 feet for the actual distance traversed by the wave in 16·5 seconds of time, being at the rate of $\left(\frac{3{,}600'' \times 790{\cdot}5}{16{\cdot}5} = \right)$ 17,251·7 feet, or 32·67 English statute miles per hour. To know how far this result is but proximate, it should be considered that, of the several elements employed in the calculation, all but one might be deemed accurate. The interval of time occupied by the transit of a wave with respect to the position of the ship, the *direction* of the ship's motion with relation to that of the waves, and the speed of the ship through the water, may all be recorded as, essentially, accurate. The element in doubt is that of the average distance from summit to summit of the waves. This distance, it has been seen, was, by a twofold process of observation or comparison accordantly assumed. The value of the judgment derived from rapid comparison of measures by an eye accustomed to such estimations is, it should be observed, far higher than might be generally considered. The practical military commander or engineer officer is able to make, by mere inspection of the ground before him, remarkably close estimates of spaces and distances. When engaged in the Arctic whale fishery, I was enabled, from habit and comparison of unmeasured spaces with known magnitudes, to estimate certain distances with all but perfect accuracy. Thus as to a circumstance in which we were most deeply interested—the near approach of a boat to a whale, I found it quite practicable, whenever the pursuing boat approached within twice or thrice its length (except when the position was near end on) to estimate the distance to less than a yard. Now, the means of comparison by the eye as to the estimation of the breadth of the Atlantic waves, was that of the ship's length of 220 feet. When the ship was fairly in the middle of the depression betwixt two waves it was assumed, with reference to this known measure, that something obviously less, but not greatly so, than the ship's length, was the distance of each of the two waves then contemplated—giving a total width of about 600 feet. But the comparison of the time required by a wave to pass from stem to stern, with the average time of transit of an entire wave, yielded a much better result; and, on much consideration of the subject, I am inclined to believe that the estimate is a tolerably close approximation to the truth. It should be observed, too, that as the headway of the ship, in the direction of the course of the wave—being a known quantity—it was favorable to the accuracy of the estimate. For, assuming an error in the width of the waves to have occurred, say to the amount of one-twelfth of the whole, or 49 feet—the effect upon the calculated velocity of the wave would have been only about a sixteenth, or 2·16 miles per hour. The form and character of these deep sea-waves became at the same time interesting subjects of observation and consideration. In respect to form, we have perpetual modifications and varieties, from the circumstance of the inequality of operation of the *power* by which the waves are formed. Were the wind perfectly uniform, in direction and force, and of sufficient continuance, we might have in wide and deep seas waves of perfectly regular formation. But no such equality in the wind ever exists. It is perpetually changing its direction within certain limits, and its force too, both in the same place and in proximate quarters. Innumerable disturbing influences are therefore in operation generating the varieties more or less observable in natural sea waves. In regard to my own observations of the actual forms of waves, nothing particularly new could be expected from an inquiry of this kind in regard to phenomena falling within the perpetual observation of sea-going persons; yet, at the risk of stating what might be deemed common, I will venture to transcribe from my notes made with the phenomena before me, the leading characteristics which engaged my attention. During the height of the gale (March 6th) the *form* of the waves was less regular than after the wind had, for some time, begun to subside. Though in many cases, when the sea was highest, the succession of the primary waves was perfectly distinct, it was rather difficult to trace an identical ridge for more than a quarter to a third of a mile. The grand elevation in such case sometimes extended by a straight ridge or was sometimes bent as of a crescent form, with the central mass of water higher than the rest, and, not unfrequently, with two or three semi-elliptical mounds in diminishing series, on either side of the highest peak. These principal waves, too, it should be noted, were not continuously regular, but had embodied in their general mass many minor, secondary, and inferior waves. Neither did the great waves go very prevalently in long parallel series like those retarded by shallow water on approaching the shore; but every now and then changed into a bent cuneiform crest with breaking acuminating peaks. On the following morning, (March 7,) after a second stormy night, wind S.S.W. (fine,) we had a heavy and somewhat cross sea (from the change of wind from W.S.W. to S.S.W.) But the almost unabated magnitude of the more westerly waves indicated a continuance of the original wind at some distance astern of us. The gale had moderated at daylight, and the weather became fine; but as the sea still kept high, its undulations became more obvious and easily analyzed. At three in the afternoon, when about a third part of the greater undulations averaged about 24 feet from crest to hollow, in height, these higher waves could be traced right and left as they approached the ship to the extent of a quarter of a mile on an average, more or less. Traced through their extent the ridge was an irregular roundbacked hill, precipitous often on the leeward side of waters. The undulations, indeed, as to primary waves, consisted mainly of these roundbacked masses, broken into or modified by innumerable secondary and smaller waves within their general body. The time in which these waves passed the ship was now, on an average, about 15 seconds, the ship's speed being increased from 9 to 11 knots, and the obliquity of the ship's course to the direction pursued by the waves was 3 points. On the 9th, two days after the above condition of the waves, whilst the sea yet ran high, few waves could be traced, continuously, above

300 or 400 yards in extent along the same ridge. The crests often curled over, but none so as to reach the height of a 30-feet wave, and broke for a wide space, estimated at 50 to 100 yards in continuity.

Miscellaneous Notes and Suggestions.—The mode adopted in these researches of finding the *height* of wave is, I believe, quite satisfactory, and, observed with care and with relation to numbers or proportion of waves, as accurate as need be. The depression of the horizon in respect to the elevation of the observer is too small to form even a correction. As the horizon from the paddle-box $\frac{30}{2} = 15$ feet, had only a depression of 3′ 49″, the distance of the visible horizon, as seen from this elevation, would be 4·45 statute miles, and the actual depression in feet due to the distance of the summit of the wave when the ship was in the midst of the hollow, could only be 0·18 feet or 2·16 inches. Other modes of determining the width of a wave—or the extent betwixt summit and summit—much preferable to that described (the only available one I could devise) might easily be adopted where the management of the ship was in the hands of the observer. In steam ships the simplest mode for high seas, perhaps, would be, altering the speed of the ship when going in the direction of the wave or against the wave; the ratios of the times of transit of wave-crests, under different rates of sailing of the ship might yield results very close to the truth. In moderate sized waves the plan adopted by Captain Stanley, whose observations I met with before this meeting, seem satisfactory. But in calms, or moderate weather after a storm—that is, for the determination of the velocities of less elevated waves, a variety of processes might be available.

The author referred, in conclusion, to the *forms* of wave crests, and heights, modified by crossings, interferences, and reflections.

Mr. Scott Russell felt a familiar interest in the results of these observations. The Section was aware that great doubts existed as to the actual heights of the waves of the open ocean. It was now past all doubt that waves 24 feet high, 30 feet high, 43 feet high, and with the swelling crest even exceeding 45 feet high, actually existed and were observed. From the observations which he had conducted many years since, he had ventured to draw up a table predicting the velocities of sea waves up to even 1000 feet from trough to crest in length. Although the apparatus which he had used did not enable him to experiment on waves which exceeded 16 inches in length, yet from these pigmy waves it was most interesting to see how accurately the law was obtained; for in his table the velocity of a wave whose length was 600 feet was set down at 30 or 31 miles per hour. Dr. Scoresby's actually observed velocity for this wave was 32 miles and a fraction.—*Proc. of Brit. Assoc.*

New Researches on the Conductibility of the Earth. By Professor MATTEUCCI.*

Although the good conducting power of the earth is at present generally admitted, and is advantageously applied to the construction of electrical telegraphs, it must be confessed that nothing has been hitherto known of the laws and theory of this singular phenomenon. In England, Germany, and Russia, it has been found advisable, for several years past, to form the telegraphic circuit partly with the earth and partly with a metallic wire, instead of forming the whole circuit with metallic wire only. I was, I believe, the first to show, by exact experiments, made in 1844 at Pisa, and by others performed according to my propositions at the Scientific Congress of Milan, that *the resistance of the earth* to the passage of the electrical current, which is sensible in short distances, ceases to increase and remains constant when the distance between the electrodes plunged in the earth has attained a certain length. Having latterly renewed my studies on this subject, I have confirmed and extended in a complete and general manner the conclusions drawn from my former researches; I have also demonstrated the principal result, given above, by different experimental processes. I have compared the resistance of a mixed telegraphic circuit with that of an entirely metallic circuit, containing a length of wire twice as great as that employed in a mixed circuit. I have also formed metallic circuits of very fine brass wires, having the same resistance as the metallic portion of a very long mixed telegraphic circuit; and finally, by making use of long metal wires covered with gutta percha, I have been able to compare the resistance of an entirely metallic circuit with that of a mixed circuit, in which the metallic portion remained constantly the same, and to which were added different lengths of earth. The following are the principal conclusions drawn from experiments which have occupied me for about a year. The resistance of a layer of earth to the passage of the electrical current varies according to the quantity of water contained in the earth of which it is composed,—according to the specific gravity of that earth,—according to its depth beneath the surface,—according to the nature of the electrodes and extent of their surface. This resistance does not increase with the increased length of the layer of earth; on the contrary, beyond a certain limit of length, which varies according to the different circumstances just indicated, but which in all cases is of little extent, the resistance of a layer of earth *remains constant* whatever be its length. It is unnecessary to say that I could not prove this fact by experiment on circuits exceeding eighty miles in length, such being the average of the telegraphic circuits in Tuscany. In making the experiment near the surface of the soil, it is difficult to plunge the electrodes in earth of exactly the same conducting power; different portions of the surface of soil possessing either better or worse conductibility than that on which I began to operate, it follows that in increasing the distance between the electrodes we may find either an increase or diminution in the resistance of the earth. Likewise, in operating on a long mixed telegraphic circuit, which is not perfectly isolated, owing to the effect of the different derived circuits formed between the posts and the earth, the electric current is stronger near the pile than at a distance, and stronger than in a circuit which is formed only of metal wire equal in length to that which enters into the mixed circuit. This explains the results which I had obtained from my former uncompleted experiments. The resistance of a layer of earth appears to diminish as its length increases only in cases where we meet with other layers of better conducting power. In every layer of earth of a certain *constant* conducting power, the resistance, which at first increases very feebly with the increased length of the layer, becomes very soon constant, and continues the same for all the subsequent lengths, however great, on which experiments have been made. Now, it is evident that as the increase of resistance in a long metallic circuit is scarcely perceptible when we add to the circuit, by means of two large electrodes, a thin stratum of water; so we ought to find in the long mixed telegraphic circuits that the resistance of the earth is null or nearly so, since it is equal to that of a thin stratum of water of a very large section. The law of the conducting power of the earth being established, it remains to give the theory of this phenomenon. The opinion of the scientific world is divided on this point. Some explain the good conducting power of the earth by the almost infinite section of the earth compared with the distance of the electrodes; others, again, suppose that the electricities at the two extremities of the pile are lissipated in the earth, in the same manner as the electricity of the conductor of an electrical machine. This second explanation will not bear the slightest examination, nor can it be made to tally with the results of the most elementary experiments relative to the conducting power of the earth. In fact, we cannot on this supposition explain why the resistance of the earth increases at first with the length of the layer; why it varies with the depth and the degree of moisture of that layer; why it changes if the mass of earth interposed between the two electrodes happens to decrease or to be wanting, as I have proved by experiments made in mountainous districts; why the interposition of a portion of earth of a different conducting power produces a variation in the resistance of the entire mass; why this resistance becomes infinitely greater when we keep this layer in a wooden trough separate from the earth, but in communication with it by means of large metallic plates. Finally, according to this explanation, the resistance of the metallic part of a mixed circuit ought to disappear—a thing which never happens. I think that I may be able to give a satisfactory explanation of the good conducting power of the earth, founding my assertions on very simple experiments, and on theoretical views already known. As long ago as 1837, I proved in a memoir published in the *Annales de Physique et de Chimie*, that in operating on a certain liquid mass, very considerable compared with the distance of the electrodes plunged in it, *the length of the intermediate liquid stratum has no sensible influence on the intensity of the current.* I have recently verified this result on a very large scale. I had a wooden case made seven metres in the side. I keep this case isolated from the earth, and filled with water. Operating on this mass of water, we find that the resistance of a certain stratum of water, variable within certain limits, is independent of its length. In like manner, in studying the conducting power of spherical masses of water varying in diameter from $2^{c.m}$ to 30 or $40^{c.m}$, I have found that the resistance of these spherical masses of water was the same, and independent of their diameter. I have already said that this result may be deduced from the theory, and this is done as follows:—From the same differential equations, given first of all by Fourier in his celebrated theory of heat, and which Ohm has applied to electricity, suppressing in the latter case the terms which expressed the dispersion of heat in the air, are deduced in the case of the sphere the results which I have obtained by experiments on the propagation of electricity in the earth. Although we are as yet ignorant of the physical value of that variable U which figures in the fundamental equation of Ohm at three partial differentials, which is the same as that of Fourier in the propagation of heat, and although that equation would really be more applicable to the case of the metallic wire which communicates at one extremity with the conductor of an electrical machine in action, and at the other extremity with the earth, than to the case of the electrical current defined by its electro-chemical and electro-magnetical action; it is no less true that a certain number of the phenomena of the electrical circuit are explained by representing the propagation of the electrical current by the same equation given by Fourier in his theory of heat.

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* From the London Athenæum, August 10, 1850.

Among these phenomena may be placed the fundamental law of the propagation of electricity in metallic wires according to their section and length, and the other more general cases of the propagation of the electrical current, and of derivation, in large metallic plates, or in spherical masses and in the earth, such as they have been found by MM. Kirchhoff and Smaaeen in Germany, and in Italy by my friends Ridolfi and Felici.

The reading of the communication from Prof. Matteucci led to a conversation on the various methods employed by the Electric Telegraph Company and others, and on the question of the investigations of Messrs. Bain and Wheatstone in England, and several experimentalists on the Continent prior to these investigations of M. Matteucci as to the power of the earth to conduct electricity—Mr. R. Hunt explained, that in speaking of the conductibility of the earth, it should be distinctly understood that the water contained in the superficial stratum is the conducting medium ;—since he has proved that non-metalliferous rocks and dry earth will not conduct an electric current.—*Ibid.*

On the Air and Water in Towns, and the Action of Porous Strata on Water and Organic Matter. By DR. R. A. SMITH.*

It is a matter of great importance to find from what source it is best to obtain water for large towns, and how it is to be collected. To these points Dr. Smith particularly directs attention. Regarding the conditions of many springs, which never become muddy, but possess a constant brilliancy and a very equal temperature at all seasons of the year, the author thinks that there is a purifying and cooling action going on beneath. The surface water from the same place, even if filtered, has not the same brilliancy; it has not the same freedom from organic matter, neither is it equally charged with carbonic acid or oxygen gas, there are other influences therefore at work. The rain which falls has not the purity, although it comes directly from the clouds; it may even be wanting in cleanness, as is often the case. Springs rise through a great extent of soil, and collect a considerable amount of inorganic salts; and it is shown by Dr. Smith that their purity is due entirely to the power of the soil to separate all organic matter, and at the same time to compel

* From the London Athenæum, August, 1850.

the mixture of carbonic acid and oxygen. The amount of organic matter removed in this way is surprising, and it is a most important and valuable property of the soil. The change even takes place close to cesspools and sewers; at a very short distance from the most offensive organic matter there may be found water having little or none in it. As an agent for purifying towns, this oxidation of organic matter is the most extraordinary, and we find the soil of towns which have been inhabited for centuries still possessing this remarkable power. St. Paul's Churchyard may be looked upon as one of the oldest parts in London, and the water from the wells around it is remarkably pure, and the drainage of the soil is such that there is very little of any salts of nitric acid in it. If the soil, says Dr. Smith, has such a power to decompose by oxidation, we want to know how it gets so much of its oxygen. We must, however, look to the air as the only source, and see how it can come from it. When water becomes deprived of oxygen, it very soon takes it up again, as may be proved by experiment. This shows us that as fast as the oxygen is consumed by the organic matter it receives a fresh portion, conveyed to it by the porous soil. Several experiments of the following character were given, to show the filtering power of the soil. A solution of peaty matter was made in ammonia; the solution was very dark, so that some color was perceived through a film of only the twentieth of an inch in thickness. This was filtered through sand, and came out perfectly clear and colorless. Organic matter dissolved in oil of vitriol was separated from it by a thickness of stratum of only four inches. A bottle of porter was by the same process deprived of nearly all its color. The material of which this filter is made is of little importance. One of the best, according to Dr. Smith, as far as clearing the water is concerned, being of steel filings,—oxide of iron, oxide of manganese, and powdered bricks all answering equally well. This shows that the separation of the organic matter is due to some peculiar attraction of the surfaces of the porous mass presented to the fluid. This paper was a continuation of Dr. Smith's Report published last year, and he purposes continuing the inquiry.—*Ibid.*

On the Incrustation which forms in the Boilers of Steam Engines, in a letter addressed to DR. G. WILSON, F.R.S.E. *By* DR. J. DAVY.*

On entering on this inquiry, which I did after my return from the West Indies in December, 1848, and after communicating a short paper to the Royal Society "On Carbonate of Lime in Sea-water," it appeared to me desirable to collect as many specimens as possible of incrustation from the boilers of steam vessels, now so widely employed in home and distant navigation. By application to companies and to friends in our seaports, as Dundee, Hull, Southampton, Hayle, Liverpool, Whitehaven, I have succeeded in procuring specimens of incrustation formed by deposition in voyages from port to port, in the British and Irish Channels and the North Sea, between Southampton and Gibraltar, in the Mediterranean and the Black Sea, and in the Atlantic Ocean, between Liverpool and North America, and between Southampton and the West Indies. I am promised specimens from the Red Sea and the Indian Ocean,—but these I have not yet received. The character and composition of the incrustation, whether formed from deposition from water of narrow seas or of the ocean, I have found very similar—with few exceptions, crystalline in structure, and, without any exception, composed chiefly of sulphate of lime; so much so, indeed, that unless chemically viewed, the other ingredients may be held to be of little moment, rarely amounting to five per cent. of the whole. From two specimens of incrustation from the boilers of steamers crossing the Atlantic, one of which you sent me, in which you had detected a notable portion of fluorine, judging from its etching effect on glass,—I also procured it, it was in combination with silica; and procured it also so combined from two obtained from steamers navigating our own seas, one between Dundee and London, the other between Whitehaven and Liverpool. Of this I had proof, by covering with a portion of glass or platina foil a leaden vessel charged with about 200 grains of the incrustation mixed with sulphuric acid, and by keeping the glass cool by evaporation of water from its surface, and by supplying moisture for the condensation of the silicated gas by a wet band round the mouth of the vessel. After about twenty-four hours under this process, a slight but distinct deposition was found to have taken place, corresponding to the margin of the vessel,—a deposition such as that produced by silicated fluoric acid gas under the same circumstances. Thus it was not dissipated by heat nor dissolved by water, and yet admitted of removal by abrasion, either entirely or in great part;—the former in the instance of the platina foil, the latter in that of the glass. Besides the ingredients above mentioned, I may add that, in many instances, oxide of iron, the black magnetic oxide, was found to form a part of this incrusting deposit, collected in one or more thin layers, and further, that in some, especially of steamers navigating the narrower and least clear part of the British Channel, the depositions presented a brownish discoloration produced by the admixture of a small quantity of muddy sediment. Incrustations so discolored, I may remark, are reported to be most difficult to detach. I have said that the incrustations, with few exceptions, were similar in their structure, and that that was crystalline;—it was not unlike the fibrous variety of gypsum of the mineralogists. The specimens received, as might have been expected, varied very much in thickness, viz., from one line and less to half an inch. I have endeavored, by a set of queries which I had distributed, to obtain information respecting the exact time in which the incrustations were formed, and under what circumstances; but with partial success only, owing, it may be inferred, to a want of exact observation. In one instance, that of the North American mail ship Europa, which arrived at Liverpool on the 15th of November, at 4 P. M., having left Boston on the 7th of the same month at 9 A. M., an incrustation was found in her boiler of about one-fiftieth of an inch in thickness; and it is stated that an incrustation of about the same thickness was found on her outward voyage. This example may aid in giving some idea of the degree of rapidity with which the incrustation is produced, at least in the Atlantic, with the precaution of "blowing off" every three hours, and with the "brine pumps" kept in constant work. In other seas, especially contiguous to shores, and more especially of shores formed by volcanic eruptions, it is probable, *cœteris paribus*, the rate of the deposition of the incrusting sulphate of lime will be more rapid. The results of the trials of several portions of sea water taken up on the voyage from the West Indies to England noticed in the paper of mine already referred to, are in favor of this conclusion. To endeavor to prevent the deposition of the incrusting matter or to mitigate the evil, various methods, it would appear, have been had recourse to,—some of a chemical kind, as the addition of muriate of ammonia and sulphate of ammonia to the water in the boiler, without success, as might be expected; others, of a mechanical kind, with partial success, as the introduction of a certain quantity of sawdust into the boiler, or the application of tallow, or of a mixture of tallow and plumbago to its inside, to prevent close adhesion, and the more easy separation of the incrusting matter either by percussion, using a chisel-like hammer, or by contraction and unequal expansion, by means of flame kindled with oakum, after emptying the boiler and drying it. Of all the methods hitherto used, that of "blowing off," that is, the discharging by an inferior stop-cock a certain quantity of the concentrated water of the boiler by the pressure of steam, after the admission above of an equivalent quantity of sea water of ordinary density, appears to be, from the reports made, the most easy in practice, the least unsuccessful, and the most to be relied on. But, as in the instance given of the North American steamer, it can be viewed only as a palliation. Considering the composition of the incrusting matter and the properties of its principal ingredient—the sulphate of lime, a compound soluble in water and in sea water, and deposited only when the water containing it is concentrated to a certain degree, there appears to be no difficulty theoretically in naming a preventive. The certain preventive would be the substitution of distilled or rain water in the boiler for sea water. Of this we have proof in the efficacy of Hall's condenser, which returns the water used as steam, condensed, after having been so used: but, unfortunately for its practical success, the apparatus is described as being too complicated and expensive for common adoption. Further proof is afforded in the fact, that the boilers of steamers navigating lakes and rivers in the waters of which there is little or no sulphate of lime, month after month in continued use, remain free from incrustation. This I am assured is the case with the steamers that have been plying several summers successively on the lake of Windermere. And it may be inferred, that in sea-going steamers in which sea water is used in the boiler,—or, indeed, any water containing sulphate of lime, the prevention of deposition may be effected with no less certainty by keeping the water at that degree of dilution at which the sulphate of lime is not separated from the water in which dissolved. From the few trials I have made, I may remark, that sulphate of lime appears to be hardly less soluble, if at all less, in water saturated with common salt than in perfectly fresh water. This seems to be a fortunate circumstance in relation to the inquiry as to the means of prevention, and likely to simplify the problem. If these principles be sound, their application under different circumstances, with knowledge and judgment on the part of the directing engineer, will probably not be difficult. His great object will be in sea-going steamers to economize the escape of water in the form of steam, and thereby also economize heat and fuel; also, when fresh water is available to use it as much as possible; and further, to avoid using sea water as much as possible near coasts and in parts of seas where sulphate of lime is most abundant. From the incrustation on the boilers of sea-going steamers, the attention can hardly fail to be directed to that which often forms, to their no small detriment, in the boilers of locomotive railway engines, and of engines employed in mines and in the multifarious works to which steam power is now applied. These incrustations will of necessity be very variable, both in quantity and quality, according to the kind of ingredients held in solution in the water used for generating the steam. Hitherto I have examined two specimens only of incrustations taken from the boilers of locomotive engines, and a single one only from the boiler of a steam engine employed on a mine—a mine in the west of Cornwall. The latter was fibrous, about half an inch thich, and consisted chiefly of sulphate of lime, with a little silica and peroxide of iron, and a trace of fluorine. The former were from one-tenth of an inch in thickness to one inch. They were laminated, of a grey color, and had much the appearance of volcanic tufa; they consisted principally of carbonate and sulphate of lime with a little magnesia, protoxide of iron, silica, and carbonaceous matter—the last two, the silica and carbonaceous matter, probably chiefly derived from the smoke of the engine and the dust in the air. From the engineer's report it would appear that the thinnest—the incrustation of about one-tenth of an inch, had formed in about a week, during which time the locomotive had run about 436 miles, and consumed about 10,900 gallons of water.—*Ibid.*

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* From the London Athenæum, for August, 1850.

On the Value of the Gaseous Escape from the Blast Furnaces at the Ystalfera Iron Works, in Continuation of a Paper read at the Meeting of the British Association in 1848. *By* MR. PALMER BUDD.*

Mr. Budd stated that, since the meeting of the Association at Swansea, he had continued, and with increased success, to apply the waste gases that escaped from the top of blast furnaces, to the manufacture of iron; and it was the result of his further experience applied to the whole of his furnaces (nine in number) since that period, that he now wished to submit to the Section. Mr. Budd then referred to his mode of applying the gaseous escape, and said it was well known that there were two descriptions of furnaces used for metallurgic purposes. The one was the blast furnace, into which air was injected, by mechanical means, at a great density, so as to penetrate upwards of 40 feet of dense materials; and the other was the reverberatory furnace, where the fire was produced by means of the draught of a chimney stack. What he had accomplished was by combining these two, so that the gaseous products of the furnace, instead of escaping through the tunnel head, were drawn sideways by a high stack, and passing through the stoves and boilers, leave behind the necessary temperature of the blast and of the steam. In a blast furnace the ores are smelted before the *tuyerès* by the conversion of the solid carbon into carbonic acid, which, passing up through the middle region of the furnace into a bath of carbon, was re-converted into carbonic oxide, capable of combining with a further dose of oxygen. It would be thus seen that the whole of the carbon of the fuel should be present at the top of the furnace in a gaseous form. When the British Association met at Swansea, he had not used the gaseous escape at any great distance from the furnace, his stoves and boilers being very closely contiguous. Further experience, however, had proved that by the aid of a stack at the end of the chain of sufficient dimensions, the gaseous escape from the furnace might be made to travel in the most tortuous directions, descending to the stoves built for heating by the usual fire-places, and traversing the boilers; the only condition absolutely necessary being that there should be an unbroken communication with the high stack at the end, into which the gaseous escape might at last pass, and by which it was drawn forward, instead of passing off wastefully at the tunnel-head. When, however, the draft was carried downward, and to long distances, he had found it necessary to drop into the top of the furnace a hopper or funnel, made of sheet-iron, which acted as a shield at the mouths of the horizontal flues, and prevented them from either being affected by high winds, or from being choked up by materials thrown into the furnace. The reason, no doubt, why this funnel was not applied before was the great apparent temperature at the funnel-head. In practice, however, it was found that until the gaseous escape mingled with the atmosphere, its heating power was not such as to injure sheet iron, or even to make it red-hot. In fact, so long as there was an escape upwards, the iron funnel would not be injured. The damage arose during and after stoppages of the furnace, when the blast was obstructed in its passage upwards by the settlement of the materials in the furnace, so that the atmosphere rushed down to meet the ascending gases, and, of course, caused a very high local temperature. His practice was to exclude the atmospheric air as much as possible. The affinity of the gases for oxygen was so great that the air leakage raised the temperature quite sufficient for safety, whilst the full combustion of the gaseous escape would melt down the bricks in the flues, and destroy the texture of the iron tube. It was not possible for him to say what combinations took place at high temperatures, where carbonic oxide, carbonic acid, hydrogen, and nitrogen, were mixed in such proportions. At any rate, he found a smothered combustion to be the most suitable and economical for the purposes in view. He was happy to say that, at length, the application of the gaseous escape had been tried in Scotland; and that at Dundyvan and elsewhere it was now in successful operation. The peculiar quality of the furnace coal of Scotland being what was called in South Wales "free burning," which, when put into the furnace raw, coked sufficiently in its descent, gave out an enormous escape, so much so that, upon a rough estimate, he calculated that the waste from one furnace in Scotland was sufficient to heat the blast, and to raise the steam for three. With anthracite coal, the minimum effect was obtained, as it was a dense fuel of nearly 95 per cent. of solid carbon; but in Scotland there would be an enormous surplus at the tunnel head. He observed that the saving at the Dundyvan Iron Works was stated to be about $1\frac{1}{4}$ tons for each ton of iron produced. Supposing, therefore, 600,000 tons of iron to be the produce of Scotland, and supposing the value of the coal used to be 3*s*. a ton, the saving that would thus be effected on the make of Scotland would amount to 112,500*l*. a year; to which might be added 20,000*l*. a year of saving in wages and repairs, which would make a total saving of 132,500*l*., or about 4*s*. 5*d*. a ton on the produce of Scotland, which on the present price of 44*s*. per ton, was about 10 per cent. on the value. If the gaseous escape could be extended to the uses of the forge, a further saving of three tons of coal would be effected,—thus making, at least, a saving of 20*s*. a ton on all the iron manufactured into bars, sheets, and rails.—*Ibid.*

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* From the London Athenæum, for August, 1850.

On a Peculiar Form produced in a Diamond when under the influence of the Voltaic Arc. By S. P. Gassiot.*

M. Jaquelin was the first to show that when the diamond is submitted to the high temperature and influence of the voltaic arc, it quickly becomes converted into a black carbonaceous matter, having all the appearance of coke:—the diamond when in a native state is an insulator or non-conductor of electricity, but when thus changed into coke it becomes an excellent conductor. At the Chemical Section of the British Association, held at Oxford, in 1847, Dr. Faraday exhibited some specimens of the diamond coke which had been forwarded to him by M. Jaquelin, and subsequently, on the 16th of June, 1848, he publicly showed the experiment in London, in the theatre of the Royal Institution. On repeating the experiment a short time since before a few private friends, I obtained a product so totally different from that of M. Jaquelin, that I am induced to bring the subject before this Section, in the anticipation that it may tend to elicit some observations on a phenomenon which at the time attracted the attention of many electricians. The apparatus I used in the experiment consisted of forty series of the usual size of Grove's nitric acid battery,—the terminals were made from two pieces of well burnt box-wood charcoal, that attached to the positive or platinum end of the battery, being formed in the shape of a small cup or crucible, in which the diamond was placed,—to the negative or zinc end of the battery, a piece of the same charcoal (but *pointed*) was attached. The experiment was then made in the same form as described by M. Jaquelin, by first making contact with the two charcoal terminals, then bringing the flame in such a position as to cause it to *surround* the diamond;—in less than one minute the diamond as well as the electrode became in a state of intense ignition. The diamond gradually increased in size, rolling about in the heated crucible, when it suddenly expanded, forcing itself upward on the negative terminal, at which moment I separated the electrodes. The diamond, which was in a state of intense ignition, remained attached to the negative terminal. When cool, it exhibited the same state as it now presents. It was expanded to eight or ten times its original bulk. Instead of becoming a black carbonaceous substance, and a good conductor, it has a vitreous white opaque appearance, and remains a non-conductor. It has also a deep circular cavity on that portion which was opposite and nearest to the positive electrode; that part which was in contact with the negative electrode being clearly discernable by a small portion of the box-wood charcoal remaining attached to it. The centre of the cavity appears to be still brilliant, as if that portion of the diamond had not been in a complete state of fusion. In one or two other experiments the diamonds disintegrated, the fragments remaining in a carbonaceous state. Since which I have not had the opportunity of repeating the experiment.—*Ibid.*

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* From the London Athenæum, August, 1850.

The Dover and Calais Electric Telegraph.[*]

Since the sinking of the first wire, circumstances have occurred calculated for a short time to retard the carrying out the project to completion, seeing that, in order to the complete establishment of an integral line of telegraphic service between London, Paris, and the continent, the promoters have to obtain a grant from the French Government of the eighteen miles of line extending from the coast to Calais, from which point to Paris the wires are erected. To secure that concession of this section, in the way of which some difficulties present themselves, Messrs. Brett, Wollaston, and Edwards, Directors of the undertaking, are now at Paris, awaiting the return of the President of the Republic, who granted the original decree, and to negotiate with the Government authorities on the subject.

In the meantime, experience of the experiments already made goes to prove that a stronger species of telegraphic tackle will be required. By the terms of contract with the French Government it was enacted—"That the Government does not reserve to itself the right of making any similar concession," but "that in case the experiment shall not result in a favorable execution by the 1st September, 1850, the right conceded will revert to the French Government." Consequent on the conditions laid down in the contract the promoters successfully submerged the wire; but, as is well known, it was subsequently cut asunder by some rocks on the French coast.

Since this happened, divers have been down, and on examination it has been found that where the rupture of the coil occurred it had rested on a very sharp ridge of rocks, about a mile out from Cape Grinez, so that the leaden weights, hanging pannier-like on either side, in conjunction with the swaying of the water, caused it to part at that point, while at another place in-shore the shingle from the beach had the effect of detaching the coil from the leaden conductor, that carried it up the Cape. The wire in its gutta percha coating was consequently cut in two places, representing a remnant of wire, of about 400 yards, which was allowed to drift away, till it came into the possession of a fisherman at Boulogne, who made a demand of 60 francs for the injury he alleges it did to his nets. Complaints are made by the fishermen, both on the English and French coasts, that the existence of this wire will interfere with their deep sea fishing, and that its track over the Varne and elsewhere is in the way of places most frequented by fish. It is intended, however, at the suggestion of Mr. J. W. Brett, to pay these people an annual rental, and to establish for their families a philanthropic fund, to induce them to unite in the protection of this great national enterprise. The assistance of the Admiralty has also been secured for the issue of prohibitory orders against fishing on the route of the electric sea line, and against ships dropping or dragging anchors over its site. The authorities of Calais and Boulogne have intimated that they will send drummers round the town to advise fishermen not to fish on these spots, and the Company will apply for powers to punish as a misdemeanor any attempts at injuring the wire. The line of wire where it was dislocated is now securely fastened on to the end of a large buoy. Her Majesty's ship Widgeon, with Captain Bullock, has traversed the rest of the track, fishing up at intervals the whole of the sunk wire out of 100 feet and 150 feet of water, and laying it down again; thus proving that it has not drifted, and that there were no currents to remove it.

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[*] From the London Mechanics' Magazine, September 28, 1850.

The promoters of the project appear to be fully apprehensive of the inadequacy of the present arrangements, and all their ingenuity is at work to be prepared to meet the emergency. Of currents it may be stated that there is no fear, since it has been ascertained that at certain fixed fathoms, even in the rapids of the Mississippi or at the Menai, there are none below three or four fathoms, and that at five fathoms there is calm water. In order to meet all existing or conjectured difficulty, the character of the undertaking, so far as its magnitude and solidity are concerned, will now be altered. The electric wire, thin as a lady's staylace in itself, will now be incased either in a 5 inch or a 10 inch cable of the diameter of those that placed the Britannia tubes in position, and these will be submerged by the aid of enormous weights. The wire will be imbedded in this gigantic coil or cable, composed of what is called whipped plait with wire rope, all of it chemically prepared, so as to protect it from rot, and kyanised; the whole to be chained down, as it were, as the rails are on a railway, by the gravitation of the huge weights in the bottom of the sea.

Dover, September 15.

For the Journal of the Franklin Institute.

Description of the Steamer "Monumental City."

As accurate data in steam navigation are among the most valuable knowledge of the day, the following notes on the "Monumental City"—a screw steamship just completed at Baltimore, by Murray & Hazlehurst—may be acceptable to the world of steam engineers.

Hull.—Of wood, coppered; length on deck, 185 feet; keel and fore-rake, 176 feet; extreme breadth of beam, 30 feet; draft of water with mean load, 13 feet; depth of hold to lower deck, 15 feet—to spar deck, 24 feet; She is barque-rigged; the fore and main masts are rigged alike, with the topsail divided in two parts, there being two topsail yards for convenience of handling;—the same arrangement obtains in the U. S. steamship "Massachusetts." The vessel is intended to ply between Panama and San

Francisco, and the water lines are a little full, in order to give stiffness under canvas, as well as to obtain displacement for load.

Engines.—Two oscillating cylinders, 44 inches diameter and 3 feet stroke, connected upon the same crank pin, nearly at right angles. Each cylinder has a separate condenser, with a pipe of communication between them. There is but one air pump, which is vertical and double-acting: $26\frac{1}{2}$ inches diameter, and 22 inches stroke, worked from a crank on the forward end of the main shaft. The steam valve is an equilibrium slide, (one to each cylinder,) worked by an eccentric on the main shaft, and cutting off by lap at $\frac{3}{4}$ths of the stroke. There is also an independent expansion valve, worked by cams on the main shaft. The piston rod is continued through the piston, and protrudes from the back end of the cylinder, in order to serve as a guide to the piston. The piston and stuffing boxes are of the usual dimensions for engines of stationary cylinders. The engines were designed by Mr. Murray, and are of the most simple and compact arrangement, well adapted for their purpose, and unexceptionable in design.

Boilers.—The boilers are tubular, planned after the usual English type, and are two in number, containing in the aggregate about 100 square feet of fire grate, and 3000 square feet of heating surface. They supply the engines with about 12 lbs. of steam above the atmosphere, from salt water, cutting off at $\frac{3}{4}$ths the stroke.

Screw.—The screw is regular, and is composed of cast iron; pitch 25 feet, diameter 12 feet; length on shaft for 5 feet diameter, 2 feet; for remainder of diameter, 3 feet,—a projection of 6 inches being given on each side. The eye of the hub is six-sided, and measures $14\frac{1}{2}$ inches across opposite angles;—thickness of hub at ends, 5 inches; at centre, 6 inches. There are four blades; thickness of blade at shaft, 4 inches, diminishing to $\frac{3}{4}$ in. at periphery. From the above dimensions, it will be perceived that the helicoidal surface amounts to about $\frac{45}{100}$ of one convolution of the thread. The edges of the blades are chamfered on the side opposite the propelling face. The screw is cast in one piece, and was placed in the vessel in the condition it came from the sand.

Performance.—The vessel having a draft of 9 feet forward, and 12 feet aft, was tried in Baltimore harbor on the evening of November 14, and made the distance between the Lazaretto Lighthouse and the Fort on Teller's Flat in 32 minutes—calm and no tide; distance obtained from the office of the Coast Survey, 4 statute miles. Revolutions of engines and screw, 42 per minute; speed of vessel, 7·5 statute miles, speed of screw, 11·97 statute miles, per hour; slip of screw, $37\frac{1}{4}$ per cent.; steam pressure in boilers above atmosphere, 17 lbs. per square inch; cut off at $\frac{3}{4}$ stroke.

The next day, the vessel having a draft of 10 feet forward, and $12\frac{1}{2}$ feet aft, there being an ebb tide and light airs, made the same distance, from Lazaretto Lighthouse to the Fort on Teller's Flats, in the same time of 32 minutes. Steam pressure in boilers, 14 lbs. per square inch; cut off at $\frac{3}{4}$ stroke; revolutions of engines and screw, 40 per minute; speed of vessel, 7·5 statute miles per hour; speed of screw, 11·364 statute miles per hour; slip of screw, 34 per cent.

In continuation, made the distance between the Fort and Bodkin Island

Lighthouse, bearing due W., in 1 hour 23 minutes; distance by Coast Survey, 8 statute miles,—allowing for sinuosities of channel, $9\frac{1}{2}$ miles; revolutions of engines and screw, 37 per minute; steam pressure in boilers, 14 lbs. per square inch; cut off at $\frac{3}{4}$ stroke; speed of vessel, 6·867 statute miles; speed of screw, 10·514 statute miles; slip of screw, $34\frac{7}{10}$ per cent.

Returning up Chesapeake Bay, November 17, made the distance from Cove Point to Bodkin Island Lighthouse in 7 hours, against head wind and tide; distance by Coast Survey, $51\frac{1}{2}$ miles. Revolutions of screw and engines, 38 per minute; steam pressure in boilers, 13 lbs. per square inch, cut off at $\frac{3}{4}$ stroke. Speed of vessel, 7·367 statute miles per hour; speed of screw, 10·796 statute miles per hour; slip of screw, $31\frac{8}{10}$ per cent. The information contained in this paragraph was communicated to me; that in the others was observed by me.

Total cost of vessel, about $80,000; of machinery alone, about $30,000.

While the vessel remained fast to the wharf, the engines were put in motion with wide throttles, and with 11 lbs. steam pressure in the boilers, cutting off at $\frac{3}{4}$ stroke, made 23 revolutions per minute.

During the above trial trip, the top of the blades were about 6 inches out of water; the slip of the screw being so considerable, there was left behind the vessel a long and broad wake. The trial trip being near the head of tide water, the speed of the vessel was but little affected by that cause. I.

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*Comparative Elasticity of Wrought and Cast Iron.**

The mean ultimate resistance of wrought iron to a force of compression, as useful in practice, is 12 tons per square inch, while the crushing weight of cast iron is 49 tons per square inch; but for a considerable range, under equal weights, the cast iron is twice as elastic, or compresses twice as much as the wrought iron.

A remarkable illustration of the effect of intense strain on cast iron was witnessed by the author, at the works of Messrs. Easton and Amos. The subject of the experiment was a cast iron cylinder $10\frac{5}{8}$ inches thick, and $14\frac{1}{2}$ inches high, the external diameter being 18 inches.

It was requisite for a specific purpose to reduce the internal diameter to $3\frac{1}{2}$ inches, and this was effected by the insertion of a smaller cast iron cylinder into the centre of the large one; and to insure some initial strain, the large cylinder was expanded by heating it, and the internal cylinder being first turned too large, was thus powerfully compressed.

The inner cylinder was partly filled with pewter, and a steel piston being fitted to the bore, a pressure of 972 tons was put on the steel piston. The steel was "upset" by the pressure, and the internal diameter of the small cylinder was increased by full three-sixteenths of an inch; *i. e.*, the diameter became $3\frac{11}{16}$ths of an inch! A new piston was accordingly adapted to these dimensions,—and in this state the cylinder continues to be used, and to resist the pressure; the external layer of the inner cylinder was thus permanently extended $8\frac{1}{50}$ths of its length. In fact, it can only be regarded as loose packing giving no additional strength to the cylinder.

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* From the London Mechanic's Magazine for October, 1850.

Under these high pressures, when confined mechanically, cast iron as well as other metals appears, like liquids, to exert an equal pressure in every direction in which its motion is opposed.—*Clark's Britannia and Conway Tubular Bridges.*

Mr. Nasmyth's Test for Oils for Lubricating.[*]

In all the contrivances which have been proposed as oil tests, a most important element has been left out, viz., *time;* inasmuch as the evil which is experienced from the use of a bad quality of oil is only developed after the lapse of several days, when, by the action of the oil upon the metal with which it is in contact, together with the action of the air, such oils become viscid, and begin to clog instead of facilitating the movements of the parts of the machinery it was intended to lubricate.

In the more delicate descriptions of machinery, such as chronometers, watches, clocks, &c., such a defect as the thickening of the oil by lapse of time is a most serious evil; and in examining into the comparative fitness of certain oils for such applications, if we do not include *time* as an element in our examination, we shall be led to form most false conclusions, inasmuch as it is the case that for the first day or two some kinds of oil (linseed oil for example) perform the lubricating duty very well; but at the end of the second or third day they become so thick and viscid as to entirely arrest the motion of the machinery.

The most valuable quality in an oil intended for the lubrication of machinery is *permanent fluidity.* That oil which will for the greatest length of time remain fluid in contact with the iron or brass is, without doubt, the most useful for the purpose. Hence, as before said, the necessity of including the element of *time* in any experiment on the comparative value of such oils.

Some idea may be formed of the importance of having the means of arriving at correct conclusions on this subject, when we know that in some spinning establishments there are upwards of 50,000 spindles in motion at the rate of 4000 or 5000 revolutions per minute! The slightest defect in the quality of the oil in such a case, by its becoming viscid, tells in the most serious way upon the quantity of fuel consumed in generating the power required to maintain at this high velocity such a multitude of moving parts. The slight increase of fluidity consequent on the rise of temperature, caused by the lighting of the gas in the rooms of a cotton-mill, makes a difference of several horses power in the duty of the engine of an extensive establishment.

The oil test we have now to describe, and which is an invention of Mr. Nasmyth's, consists of a plate of iron 4 inches wide by 6 feet long, on the upper surface of which six equal-sized grooves are planed. This plate is placed in an inclining position, say 1 inch in 6 feet. The mode of using it is as follows:—Suppose we have six varieties of oil to test, and we are desirous to know which of them will for the longest time retain its fluidity when in contact with iron and exposed to the action of the air; all we have to do is to pour out *simultaneously* at the upper end of each inclined groove an equal quantity of each of the oils under examination. This is very conveniently and correctly done by means of a row of small brass tubes. The six oils then make a fair start on their race down hill; some get a head the first day, and some keep a head the second and third day, but on the fourth or fifth day the truth begins to come out; the bad oils, whatever good process they may have made at the outset, come soon to a standstill by their gradual coagulation, while the good oil holds on its course, and at the end of eight or ten days there is no doubt left as to which is the best; it speaks for itself, having distanced its competitors by a long way. Linseed oil, which makes capital progress *the first day*, is set fast after having traveled 18 inches, while second-class sperm beats first-class sperm by 14 inches in nine days, having traversed in that time 5 feet 8 inches down the hill. The following table will show the state of the oil race after a nine days' run:—

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[*] From the London Mechanic's Magazine for October, 1850.

RESULTS OF OIL TEST.

Descript. of Oil.	1st.		2d.		3d.		4th.		5th.		6th.		7th.		8th.		9th.	
	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
Best sperm oil ..	2	8½	4	2	4	5¾	4	6	4	6	4	6	4	6⅛	Stat.			
Com. sperm oil .	1	7	3	9	4	6¾	4	11	5	1½	5	4	5	6¾	5	7⅜	5	8
Galipoli oil	0	10¼	1	2¼	1	6	1	6½	1	7⅝	1	8¾	1	9	1	9¼	1	9½
Lard oil	0	10¼	0	10½	0	10¾	0	10¾	0	11¾	Stat.							
Rape oil	1	2½	1	6¼	1	7	1	7⅛	1	7¼	1	7¼	1	7¼	1	7¾	Stat.	
Linseed oil	1	5½	1	6	1	6¾	1	6¼	1	6¼	1	6¼	1	6¾	Stat.			

Improvements in Forging Iron. By Mr. James Nasmyth.*

[Read before the Mechanical Section, British Association, Edinburgh.]

Before proceeding to describe the nature of the improvements in question, Mr. Nasmyth made some remarks on the value and importance of any improvement which tended to increase the certainty of the production of sound and perfectly solid forgings of wrought-iron, more especially those massive forgings required for such purposes as paddle-shafts for marine engines, crank and plain axles for locomotive engines, anchors, and such like; on the soundness of which both life and property, to a vast amount, may depend. Mr. Nasmyth instanced several cases in which paddle-shafts of marine engines had given way, although, in the first instance, they had all the *outward* aspect of the most perfect soundness, but which, on fracture, exhibited the existence of original defect, in being little else, internally, than a mass or bundle of loose bars of iron, which had never been in a sound welded union, but had only been held together by the exterior, where alone the welding had been so far perfect.

The chief cause of such defects was traced to the action induced on the centre part of the metal of such shafts, by the action of hammering such cylindrical forms between two *flat* surfaces, as in the case of a forge hammer and anvil of the ordinary construction.

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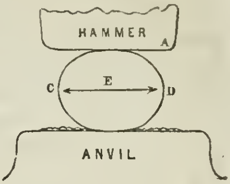
* From the London Mining Journal, No. 791.

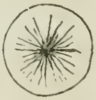
Fig. 1.



Mr. Nasmyth exhibited a diagram, of which fig. 1 is a copy, in order to illustrate the action induced on the centre portion of a cylindrical forging, when produced under the action of a flat-faced hammer and anvil.

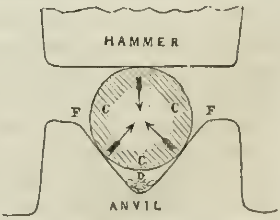
It will be seen at once that the action induced on the centre portion of the metal of a shaft or such like cylindrical form, by the successive blows of a *flat*-faced hammer and anvil, as A and B, is to cause the work to spread out or extend in the direction of E D, E C (as represented by the double pointed arrow in the figure), and as the flattened out form has to be attempted to be corrected by turning the shaft round and round on the anvil, so that each successive blow may be made to correct the spreading out caused by the previous blow, the result of this action is a fretting or mincing of the centre part of the metal of the shaft, resulting in a separation of the metal throughout the entire centre portion of the shaft, somewhat after the manner indicated in fig. 2, frequently to such an extent as to permit the passage of air or water from end to end of shafts forged in this manner. The effect of this kind of unsoundness is, that it is certain, sooner or later, to work out towards the exterior, and, in all probability, result in a "break down" more or less disastrous in its consequences.

Fig. 2.



Mr. Nasmyth then proceeded to describe his improved form of anvil face, by the employment of which all such defects as detailed above are avoided. Such has been the perfect success and excellent results which have attended the use of his improved anvil face, that its adoption has become almost universal, and the production of absolutely sound, solid, wrought iron shafts, of whatever magnitude, rendered equally easy as certain.

Fig. 3.



A (fig. 3), represents the form of Mr. Nasmyth's improved anvil face, which he terms a V anvil, between the jaws of which the work to be hammered is placed, as indicated by a cylindrical shaft seen in section marked C, C, C. A glance at fig. 3 will, no doubt, render its action evident—viz., that the effect of each blow of the hammer on the work, C, C, C, instead of causing, as in the case of fig. 1, a *diverging* action on the centre portion of the work, occasions, on the contrary, a *converging* action, as represented by the three arrows, and instead of having the centre portion of the metal of the shaft rendered less compact and solid by the action of the blows of the hammer, we have quite the contrary effect produced; besides which, owing to the wedge-like form and action of this V anvil face, the compressing effect of the blow is most importantly enhanced, and the ease and rapidity with which such cylindrical work as shafts and the like can be produced by such means is most remarkable, so much so as to enable the forgeman to hammer out *at one heat*, by means of this V anvil, as much as would require three heats on the common flat-faced anvil; add to which the vast convenience which the fork-like form of the V anvil yields, in keeping the work at all times right under the centre of the hammer, as it is turned round and round to receive the successive blows, which, in the case of work of the largest class, is a matter of no small trouble. Another advantage consists in the free passage, or exit, which is at all times preserved for the escape of the scales and impurities which fall from the hot iron during the process of hammering, which scales fall down towards the apex of the V at D, and trickle away—thus removing the cause of blemish and roughness which is occasioned by such scales collecting on the face of the flat anvil, and getting beat into the surface of the forging.

It will be seen, on inspecting fig. 3, that one such V anvil face as there represented will accommodate a vast range of diameter of work—namely, all diameters such as will neither absolutely rest on the bottom of the apex, D, or on the corners, F, F.

Mr. Nasmyth has taken every means by the most free communication to promulgate among those interested the advantages of this V anvil, and has been rewarded by seeing its use become almost universal. Mr. Nasmyth stated that an angle of 80° was found by him to be most generally suitable for the inclination of the sides of the V, and also that the edges should be well rounded off, and the surface of the V sides curved in the direction of the *axis* of the work to the extent of $\frac{1}{8}$th of an inch in 12 inches, so as to be "prowd" in the centre, and so facilitate the extension (axis ways) of the work. The great simplicity, as well as the important results which are yielded by the employment of this V anvil face, has in no small degree, contributed to its almost universal adoption. Its employment renders the production of perfect sound work easy and certain.

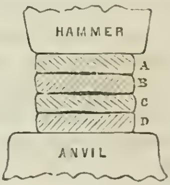
Mr. Nasmyth next proceeded to describe the second part of his improvements in forging iron, which consists, as in the first case, of means equally certain and simple in producing sound boiler-plates. Mr. Nasmyth prefaced the description of his improvements on this truly important subject by detailing the nature of the most frequent *cause* of unsoundness of iron forgings generally, and in boiler-plates in particular—namely: the imperfect expulsion of the molten oxide of iron "scoria," or "cinder," as it is termed, which, in every case of welding, hot iron covers and clings to the surface of the metal; and, if left interposing between the welded surfaces, is certain to occasion a defect greater or less, according to the surface of junction it occupies. The frequency of this interposing scoria as *the true cause* of unsound forged work, was forcibly alluded to by Mr. Nasmyth, and shown to be the most fertile source and cause of the failure of wrought iron work, resulting as such too frequently does in the most sad and disastrous accidents—such as the failure of the links of chains and anchors, and in the costly and often distressing results arising from defective (*i. e*, *blistered*) boiler-plates.

In respect to the links of chains, Mr. Nasymth mentioned as the result of an extensive series of experiments on the strength of chain cables, on which, as member of the "committee on metals," he was employed by the Admiralty, out of every 10 cases of fracture, eight were occasioned by defective welding, as evinced by the appearance of the surfaces, which present to a practical eye appearances not to be mistaken, owing to the very peculiar aspect of the surfaces of the *apparently* welded metal, between which surfaces the oxide, or scoria, had not been duly expressed.

Mr. Nasymth further described the condition absolutely requisite to perfect welding—namely: not merely that the surfaces we desire to weld should be really "welding hot," but also that, when brought into contact, no particle of the scoria, which inevitably clings to the metal while welding hot, should be permitted to remain interposing between such surfaces. If such material is left interposing, we are certain to have defect and unsoundness, to a greater or less extent, as the result.

In order the more clearly to detail his improvements on this important subject, Mr. Nasymth exhibited a colored drawing, representing the usual form and arrangement of a "pile" of "slabs," such as are employed when welded together, to form a mass of iron, from which boiler-plates, or bars of iron, are rolled. Fig. 4 represents such a "pile" of "slabs" which, having been, as is generally the case, produced under the action of a forge hammer and anvil, having flat or, as is generally the case, slightly *convex* surfaces, causes the slabs so produced to have certain *hollow* parts, or slightly concave portions of their surfaces, so that, when piled one upon the other, as in fig. 4, the risk of having hollow spaces is almost certain. The hollow spaces are represented in the figure by the dark irregular lines between the slabs.

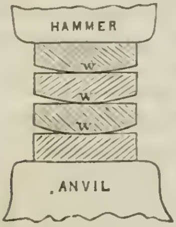
Fig. 4.



Referring to fig. 4, A, B, C, D, represent a pile of four slabs, laid on the anvil welding hot. Owing to the *concave* irregularities of the surfaces; the parts most certain to come into contact first are generally the exterior edges of the slabs. The effect of the blows of the hammer is first to weld the parts in natural contact, and by continuance of the blows the interposing scoria, or cinder, is expressed in a degree more or less perfectly, according to the energy of the blows, and the deepness of the convex, or hollow patches, betwixt the slabs. *So long as there exists an exit,* or passage, for the scoria all is well; but, as generally happens, some portion of the scoria lurks behind, after all chance of escape is removed by the welding of the exterior portion of the surfaces of the slabs. The result of this is that we have, to a certainty, a defect, greater or less in amount, according to the quantity, or surface, over which the *enclosed* scoria extends. Once such scoria is shut up between the surfaces of the slabs no amonnt of after hammering will ever expel it, but, on the contrary, will only tend to its extension over a larger surface; and, as before said, so long as a particle of this scoria is left interposing, so have we a degree of unsoundness in proportion.

Great as this evil is, and common as it is as a fertile cause of defective iron-work, and the more especially so in the case of boiler-plates, the means of avoiding such source and cause of defect is as simple as the results are important; and it is to be hoped that the free and open communication which Mr. Nasmyth has made of his views on this subject will be answered in the most acceptable way by the general adoption of his improvement, as certain means of avoiding the occurrence and existence of all such causes of defective boiler-plates and forge work generally, which improvements consist simply in so forming the surfaces which we desire to weld together that a free exit may be preserved to the last for the escape of the molten oxide, or scoria, until the entire surfaces of the parts we desire to weld are thoroughly incorporated by the welding property, under the action of the hammer, or rolls, as the case may be.

Fig. 5.



In order to accomplish this most important and desirable object, Mr. Nasmyth forms the surfaces of his slabs *convex* (see fig. 5), by which most simple means a most perfect free exit to the scoria or interposing impurity is maintained to the last moment, the welding commencing at the centre part of the contact, W, and extending outwards towards the edges under the action of the successive blows of the hammer, or squeeze of the rolls; but, as before said, an open door is kept for the escape of the scoria, until the surfaces unite from the centre, W, to the outside edge, Z, Z, Z, Z. Here, then, by an arrangement, or formation, of the surfaces we desire to weld we have the most certain and simple means of procuring a perfectly solid sound mass of iron, which, when beaten, hammered, or rolled down to whatever thickness we desire, will retain to the last all the qualities of the one sound solid mass we had converted it into by this most simple improvement—viz., giving to the surfaces we desire to weld *a convex* form, and relation to each other.

Mr. Nasmyth concluded his observations on these important subjects by an earnest appeal to the members of the mechanical section to diffuse, by all means in their power, the information which, on this as on all such subjects, he will ever feel the highest pleasure in communicating to the practical men of his profession, who may think fit to accept these results of an active life, which he finds so much pleasure in freely sharing with them.

Proportions of Steps and Staircases. By J. BURGES WATSON[*]

As the following system may not be generally known to the profession, I send it, hoping that other members may, from time to time, communicate their ideas on points connected with our art:—

The late Mr. Thomas Tredgold named it to me as one to govern us in carrying out a properly proportioned step. He stated, that as it was admitted that a person of ordinary stature moved on level ground over a space of two feet at each step, and as the lifting of the foot was attended with about double the amount of exertion as advancing it forward, he considered the twenty-four inches should be so divided, that *twice* the rise, added to *once* the tread, should *always make up* that number; for instance, if the step was 6¼ inches rise, it should be 11½ inches tread, or 6⅜ inches rise to be 11¼ inches. I begin with these figures, as giving

[*] From the London Architect, for September, 1850.

good proportioned steps (for I have always considered a 6-inch rise as rather less, and a $6\frac{3}{4}$-inch rise as rather more, than the best proportion for general use.) But in forming a handsome staircase, where we are seldom confined either as to height or space on the plan, we may exercise our skill and judgment as we like, by having our steps 4 inches by 16 inches tread, or 5 inches by 14 inches tread; or, in a contracted space, when a steep staircase is *unavoidable*, 7 or 8 inches rise × 10 or 8 inches tread respectively—*all making up the 2 feet*. And it will be found that the *going*, as it is called, will, by this rule, be about the best that could be adopted, although I need hardly say that both extremes as to rise are better avoided.

*The Atmopyre: For Converting Gas into Fuel for Economic Uses.**

Many have been the attempts and suggestions to substitute coal gas, and other combustible elastic fluids, for coal fires, as far more cleanly, more easily managed, and as giving a far more regular and quickly-adjustable temperature. None of the plans hitherto adopted have, however, met with more than partial success, such as the application of gas burners to hot plates, boiling liquids, &c. It has been reserved for Mr. D. O. Edwards, a member of the College of Surgeons, to hit upon a plan at once founded on the most scientific principles, with an adaptability of being applied to every purpose for which open coal fires have hitherto been employed. It is well known that flame is a hollow cone, its exterior being formed by the evanescent particles of carbon, which being, for the moment, precipitated in a solid form after the combustion of the hydrogen, and raised to a white heat, give out light in virtue of that transient solidity. This occurs the instant before the union of the carbon with the oxygen of the atmosphere, and their conversion into carbonic acid, which forms an invisible pellicle round the flame. The heat to which this carbonaceous shell is raised is very high, but as soon as it is engendered, it is carried away by currents of the surrounding atmosphere. The possibility of arresting and detaining this heat was the problem the inventor proposed to solve. Meditation on the Davy safety-lamp afforded a clue. This lamp is a chamber, which, when its preserving agency is required, is filled with flame; the walls are perforated with minute holes, through which air and gas freely pass, but which are impermeable to flame. The incandescent gas, in its transit through these apertures, is robbed of its heat, the flame is extinguished, and the heat is developed in the wire-gauze, which becomes red-hot. Here, then, was the principle; the material suitable was the next consideration; all the metals are too oxidisable, except platina, which was too expensive; a mixture of one-third china-clay, and two-thirds common pipe-clay, was employed. Cylinders of various sizes, from 2 to 4 in., were formed of this material, perforated with numerous orifices, and having a circular opening at one end, to screw on to a No. 4 gas burner. This cylinder, or hood, is the converse of the Davy lamp, the gas being inside instead of out; and on escaping through the holes, and fire being applied, the hood, in one minute, becomes red-hot, having the appearance of a mass of red flame; but an aggregate or battery of these hoods, placed in a circle, and covered with a case, are heated to an orange color, and a temperature has been obtained sufficiently high to melt the more refractory metals—gold, copper, iron, &c.

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* From the London Mining Journal, No. 787.

For warming apartments, this appears to us the most cleanly and efficient means ever yet proposed, and the inventor applies it in the following manner:—A battery of 12 "hoods" is inclosed in an earthenware case, which, becoming heated to 500° Fah., forms a repository of heat. This is placed in an outer case of china, terra cotta, or any other ornamental ware. The products of combustion are carried away by a small pipe into the chimney. The fresh air is brought from outside the dwelling through a tube about 6 in. diameter, which communicates, by means of a valvular iron plate, with the space between the two cases. The air ascends in this area in large quantities, is warmed in its transient contact with the inner case, enters the room through large holes in the top of the stove, at a blood-temperature, and spreads equally through the apartment. The fire presents a cheerful aspect through the wide orifice of the stove, which is covered with glass, and is visible to every inmate, and the expense of such a fire is 6d. per day, at the present price of gas.

This new fire is applicable to every variety of culinary operations—to roasting, boiling, baking, broiling, frying, stewing, and toasting, affording a steady, and easily adjustable heat. As roasting by this method is effected in close chambers, an idea may prevail that the meat is only baked, but such is not the case. In roasting, a heat of about 350° Fah. is sustained at the surface of the joint, which is slightly charred; the fluids in the interior of the meat are raised to a temperature of 212°, and the flesh is thus boiled in its own juices. The internal heat can never be above 212°, the boiling point, because at that point liquids are converted into steam, which never imparts, in its natural state, a higher degree of temperature. The atmopyre is undoubtedly an economic source of heat for all domestic purposes, can eventually be brought into use for all manufacturing uses, and as an agent for the prevention of smoke will be invaluable. Applied to refining gold and silver, the furnace may be kept up at an expense of 2d. per hour; in this case the argillaceous envelopes are doubled and trebled, to insure an accumulation of heat equal to what is known as the "wet" heat. To produce steam, 50 ft. of gas consumed per hour is equal to one horse power, and this heat increases at a given direct ratio with the size of the furnace. As coal gas can be safely compressed into one-sixtieth part of its bulk, the atmopyre is applicable to steam-boats without exception, whose voyages are limited to 20 days. The heat of the atmopyre is so susceptible of exact regulation, that the most delicate aromatic herbs have been desiccated by it. It affords means of purifying bedrooms, and warming every description of apartment or public or private building, and is most important in a sanitary view. Add to this, it not only possesses great cleanliness, but that great desideratum to an Englishman's fire-side, a cheerful fire, is hereby eminently obtained, for we can imagine nothing more brilliant than a battery of a dozen of these cylinders glowing in an intensity of incandescence. The following is an extract from a letter to Dr. Faraday, containing details of some of the experiments.

Mr. Palmer, the engineer of the Western Gas Light Company, writes me the following account of some experiments made by him:—

1. The gas was turned on to the 12 burners or "hoods," and the flames adjusted to blue small jets, which produced a flickering explosive combustion.

2. In three minutes the "hoods" had all acquired a dull red heat, and in 7½ minutes the concentric cube or cylinder surrounding the "hoods" had acquired the like temperature.

3. The combustion of the gas was so perfect, that the "hoods" were not discolored by undecomposed carbon.

4. In 17 minutes the average temperature of the large room, containing 8551 cubic feet of atmospheric space was raised from 65° to 70° Fahr., whilst the extraordinary small quantity of 2 cubic feet only of gas was expended. It is necessary to remark that there was no ventilation in the room during the said 17 minutes above the fire-places, the ventilators nearly level with the ceiling having been both closed, and the entire products of combustion were not permitted to escape. The apartment, for want of ventilation, had become rather unpleasant to the respiration. Reasoning upon the extarordinary amount of heat developed in Mr. Palmer's experiment, it occurred to me that if this amount of heat could be concentrated in a small compass, an enormous furnace could be produced, and I accordingly constructed a small furnace, consisting of 12 "hoods," inclosed in an earthenware cylinder of 6 inches diameter, and built in an oven of Stourbridge bricks, of 6 inches thickness; the interior area measured 8 inches cube, or 512 cubic inches. In two hours after this little furnace was kindled, a heat equal to the melting of silver was produced. In four hours its maximum heat was apparently produced, there being no indications of increased temperature on the surface of the little kiln afterwards. In 36 hours the iron burners in which the earthenware "hoods" were placed, were partially fused, being inseparably united to the earthenware.

On Resin and Water Gas.*

In a leading article in the *Mining Journal* of the 24th August last, we made some observations on Dr. Fyfe's report, on the character of Mr. S. White's patent hydro-carbon gas, and which report gave so contradictory an account of its properties and value to that which Mr. White claimed for it. Mr. J. W. Hodgetts, of Manchester, has now replied to Dr. Fyfe, and we must admit that his report appears founded on most careful analysis, and is marked throughout by candour and good feeling. He says the principal sources of error in Dr. Fyfe's very elaborate and very interesting report, are—"first, he has tried his experiments with an apparatus erected under an old patent of Mr. White, since abandoned, and replaced by an improved one under his new patent of 1849. Secondly, he has adopted a process essentially differing from that of Mr. White.—His retort was *stuffed with charcoal and scrap iron*, thus producing hydrogen, by allowing the water to come in contact with the hot iron, whereas Mr. White decomposes water with heated charcoal alone, and *subsequently* passes the resulting gases through heated iron borings. Thirdly, he begs the whole question at issue, by assuming throughout his argument that the gases produced by water merely *mix* with those arising from the resin, instead of *chemically combining* with part of them in their nascent state, as I hope presently to prove that they do. Fully agreeing with the doctor, as I do, in 'the extreme absurdity of putting any confidence in specific gravity alone as a test of the value of a gas for the purpose of illumination,' curiously corroborated by Prof. Graham himself; who states in his evidence on Croll's bill, that, 'unless an experiment on specific gravity is combined with an analysis, it may lead to fallacious results,' I will not imitate him in going at considerable length into this very question, but will simply state that I believe the average specific gravity of Mr. White's gas, after passing the lime purifiers, and being thereby deprived of most of its carbonic acid, slightly exceeds 700; to bring it to 924 would require an enormous quantity of carbonic acid." Mr. Hodgetts then proceeds to show, from his own observations, corroborated by the regular reports received from the towns and manufactories employing it, that each 1 cwt. of resin produces from 1500 feet to 1800 feet of gas, 4 gallons of resin oil, and two-thirds of a gallon of naphtha; or, using all the oil over again, which makes the product clearer, 2500 to 2800 feet of gas with two-thirds of a gallon of naphtha, the gas slightly exceeding our Manchester and Salford Cannel gas in illuminating power, as tried against the same candle by the photometer. Mr. White's process is simple enough. His vertical 6-feet retort, having a small quantity of iron borings at the bottom, is filled up with wood charcoal, which is, of course, brought to a high heat. A small stream of water falling upon the charcoal, is, either upon its direct contact, or subsequently as vapor, passing through 6 ft. of carbon, converted into carbonic oxide, carbonic acid, hydrogen, and a little light carburetted hydrogen. Most of the carbonic acid subsequently yields an equivalent of its oxygen to the iron, and passes off as carbonic oxide.

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* From the London Mining Journal, No. 787.

These mixed gases are now conducted from the bottom of the vertical retort by a pipe into the horizontal retort, where they instantly come in contact with those gases in the nascent state, which arise from the decomposition of a small stream of resin constantly falling on the red-hot retort —viz: olifiant gas, light carburetted hydrogen, naphtha, and a little light oil, besides a further small portion of each of the other gases. But now comes the main question on which the merit of Mr. White's invention chiefly hinges, viz., Do these gases form a simple mixture, or does the large quantity of carbonic oxide, proceeding from the water retort, so combine with either carbon or naphtha, as to obtain from them that illuminating power in which it is previously so confessedly deficient, as almost to justify Dr. Fyfe in classing it as *nil*, and "worse than nil?" Mr. Hodgett's reasons are these: 1. The known products of water decomposed by hot charcoal, if simply *mixed* with the equally well known products of resin decomposed by red-hot iron, in equal proportions, could not possibly produce a gas of much more than half the illuminating power of good Cannel gas, whereas they *do* produce one of superior power. 2. It has been found by repeated experiments, that if Mr. White's resin retort is worked without allowing the access of the water gas, it will be completely choked up with a deposit of carbon in four hours; whereas, when worked in the usual way, it is by no means choked in 12 hours, though it ought then to be cleaned. If no combination has taken place where has all this carbon vanished to? 3. The combination of carbonic oxide with naphtha is the very ground on which Mr. George Lowe took out his patent for naphthalizing coal gas; indeed, he has often said that the more carbonic oxide the gas contained, the more highly illuminating power the naphthalized gas posseses; for, according to his own original and forcible words, "though carbonic oxide possesses no illuminating power in itself, it is the best possible beast of burden for carrying it."

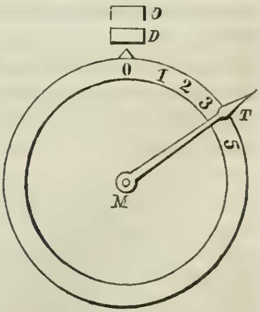
Mr. Hodgetts then proceeds to say that, at all events, Mr. White *does* produce 2500 feet of good gas, and two-thirds of a gallon of naphtha from each hundred-weight of resin, and does, by means of his water gas, greatly lessen the deposit of carbon in the resin retort; and as these assertions may, by experiment, be easily proved or disproved, all doubters are invited to "go and see." The spirited corporation of Manchester are at present allowing the erection of White's apparatus on their works, to try the economy of converting their immense production of tar into gas by its means; and the result of this trial will pretty much decide the merits of it.

Electric Telegraphs. *By* John MacGregor.*

In No. 1409 of your present volume there is a notice of a patent for some improvements in Electric Telegraphs—and amongst the abstracts of claims is the following:—

"8. An arrangement for sounding one out of a number of alarums:"

It is impossible, of course, to infer from this brief notice what are the particulars of the invention, and I am not aware of the mode at present adopted. If there be none, by which one only out of a number of stations may be signalled, then I would propose for consideration a plan for effecting this desirable object which occurred to my mind some time ago.



Let the accompanying figure represent a wheel, with marks 1, 2, 3, and 4, at equal distances on the circumference, and corresponding in number to the whole number of stations, say 60, connected by telegraph.

Let the axle of this wheel be made to turn once in a minute by clock-work, and the wheel be so placed on the axle that so long as a detent D rests on a projection P (opposite to the mark O), the wheel shall be at rest; but when D is lifted (by electricity), the wheel shall have sufficient friction-hold on the axle to cause it to turn round in the same time—that is, once in a minute. Now let R be a radial arm, capable of being placed at any of the marks 1, 2, 3, &c., and furnished with a projection T, which shall always pass free of D, but be caught by a catch C, provided that catch descends when

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* From the London Mechanic's Magazine, for October, 1850.

T is within a certain distance on either side of the line C M. The catch C is supposed to be moved by electricity, and if it falls so as to strike T, the wheel will be stopped, a certain circuit completed, and a bell rung; but if C does not fall on T, it will be wholly inoperative on the machine.

A wheel, similar to that described, should be at every station, and in general the radial arm R at each station should be left opposite to the particular number denoting that station.

Thus the arm R, at No. 2 or No. 27, will be at angles at the line D M, particularly representing such stations respectively.

Supposing magnets, circuits, and bells to be so arranged that the bell of each station shall be set ringing only when a current is completed through C and T, we may describe the action of the instrument as follows:

If station No. 20 *requires to correspond with No.* 35, then—

1. Put the arm R opposite the mark 35 on the rim.
2. Send a current along the wire which will release the detents D *at all the stations*, and all the wheels will commence moving (at nearly the same rate.)
3. When the point T comes under C, (that is, in 35 seconds,) the similar point at station No. 35 will then be beneath its catch; therefore, send another current along the line, which will affect only wheels No. 35 and No. 20, and will ring the bell of 35.
4. After the communication of the message, return the wheels 20 and 35 to their original position. All the other wheels will have gone round for *one minute*, and will *themselves* have come into the exact position they were in at first.

By this means, the average time (in the above supposed circumstances) required to signal one station would be half a minute; but if that should be thought too long (!) the wheels might move at double the proposed rate, and the convenience of this plan will depend on the time of revolution of the wheels, and the amount of margin which can be permitted on either side of a perfect agreement of their motions.

We shall see that a comparatively inaccurate adjustment would not impair the usefulness of this simple apparatus; for if the catch C were made of such a breadth as to operate on T when it is at the distance from the line M C, represented by *nearly* half an interval on either side of that line, an error of nearly half a second in a minute may be allowed without deranging the instrument.

Howth, Sept. 14, 1850.

The New Steamship "Africa."[*]

The "Africa," the latest built of the British and North American royal mail steam fleet, sometime ago made the trip from Greenock to the Bell Buoy in sixteen hours, against a gale of wind which threw the spray clean over the vessel, and high up the funnel. But in the strength of the gale she made thirteen-and-a-half knots. She had previously made a trial trip from Greenock to the Cumbraes, on which occasion she sailed with comparative ease fifteen miles against a strong tide and wind in an hour and three minutes. She can scarcely be distinguished from her duplicate, the

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[*] From the London Railway Journal, for November, 1850.

"Asia," being made from the same lines and moulds, both as regards hull and machinery. We may also add that we hear, that to keep up to the necessities of the times, the Company are about to lay down two more steamers, to be twenty feet longer than the "Africa," and of proportionate power.

	Ft.	In.
Length of keel and fore rake,	267	0
Breadth of beam,	40	6
Depth of hold,	27	6
Length on deck,	265	0
Breadth on do. at midships,	37	2
Depth of hold at do.,	27	2
Tonnage,	2,226 24-100	

A pair of side-lever engines of 814-horse nominal power. Diameter cylinders, 96 inches × 9 feet stroke; paddle wheels, diameter, 27 feet 7 inches, and 26 feet 10 inches effective; 28 floats, 9 feet 2 inches × 3 feet 2 inches, three sets of 28 arms, 8 floats in the water at 19 feet draft of water. Four flue boilers, twenty furnaces; bunkers to hold 890 tons of coals; thirty-eight hands in the engine-room. The "Africa" is built of the best British oak, and planked double out and inside, and between the frames is filled up, from the keel to the gunwale, with rock salt, to preserve the vessel from the dry rot. The number of her berths will enable her to carry 180 passengers. The quantity of coal she is estimated to carry is 900 tons, and she has capacity for the transit of 600 tons of cargo, not including ship stores.—*Liverpool Times.*

How Mud-Hole Doors ought NOT *to be put on Steam Boilers.*[*]

A shocking accident occurred on the 10th inst., on board the "Erin's Queen," a screw steamer, trading between London and Belfast, by which the chief engineer, John Fergusson, was scalded to death. It appeared from the evidence that the mud-hole doors over the furnaces were *put on outside*, and the attention of the chief engineer being drawn to one of them leaking when steam was up, and the boat about to proceed down the river, he attempted to tighten up the nut, and in doing so the bolt broke, and the door was blown off, and the unfortunate man was blown with it to the other of the stoke-hole, and of course instantly scalded to death. Mr. Edmund Green, the engineer of another vessel, and Mr. W. K. Whytehead, C. E, were examined to show the error which had been made by the constructor of the boiler in putting the doors on the outside instead of the inside of the boiler. At the suggestion of the latter, the coroner read, for the guidance of the jury, the following passage from Bourne's *Treatise on the Steam Engine p.* 230. "It is much the safest way to put on both mud-hole and man-hole doors from the inside, with cross-bars on the outside to keep them closed. The plan sometimes followed of putting on mud-hole doors from the outside, and securing them by one or two bolts, is a practice we have already reprehended as full of danger, as if the thread strips, or the bolt breaks, the door will fly off, and the boiling water rush out, scalding every one in the vicinity. Mud-hole doors of this kind, even if they leak, cannot be screwed up to tighten them when the steam is up, as there is a perpetual risk in tightening the doors of stripping the thread, or breaking the bolt."

[*] From the London Artizan, for November, 1850.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, November 21st, 1850.

S. V. Merrick, President, in the chair.

Thomas Fletcher, Vice President.

Isaac B. Garrigues, Recording Secretary.

John F. Frazer, Treasurer.

The minutes of the last meeting were read and approved.

Letters were read from The Royal Institution, and The Royal Society, London; John Fagan, Esq., Winchester, Va., and R. P. Gillingham, Philadelphia.

Donations were received from The Statistical Society, and The Chemical Society, London; Thomas Ewbank, Esq., Washington City, D. C.: Hon. Joseph R. Chandler, United States Congress; A. S. Barnes & Co., and Brady, d'Avignon & Co., New York; Dr. Robert Hare, Daniels & Smith, Henry Perkins, H. Whitall, The Controllers of the Public Schools, and John F. Frazer, Philadelphia, and John Fagan, Esq., Winchester, Va.

The periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statements of the receipts and payments for the months of September and October were read.

The Board of Managers and the Standing Committees reported their minutes.

The Committee on Exhibitions presented their report on the late Exhibition of American Manufactures, held during the past month.

Resignations of membership in the Institute (72) were read and accepted.

Candidates for membership in the Institute (149) were proposed, and those proposed at the last meeting (17) were elected members of the Institute.

On motion, Professor John F. Frazer was authorized, in the absence of the Corresponding Secretary, to sign the Certificates of the *Third Premiums* awarded at the late Exhibition by the Committee on Exhibitions.

On motion, the letter from R. P. Gillingham, Esq., was referred to the Committee on Exhibitions.

Mr. John E. Addicks, from the Committee on Exhibitions, stated that the Committee in their report recommended to the Institute to award the *Gold Medal* to

The Sagamore Company, Portsmouth, N. H., for No. 1061—White and Colored Six Cord Spool Cotton; and to

Lippincott & Co., Philadelphia, Penn., for No. 3320—Specimens of Book-binding.

On motion, the above awards were made.

The Committee on Exhibitions presented the Report of the Judges on Lamps and Gas Fixtures, which was discussed, and referred back to the Committee.

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